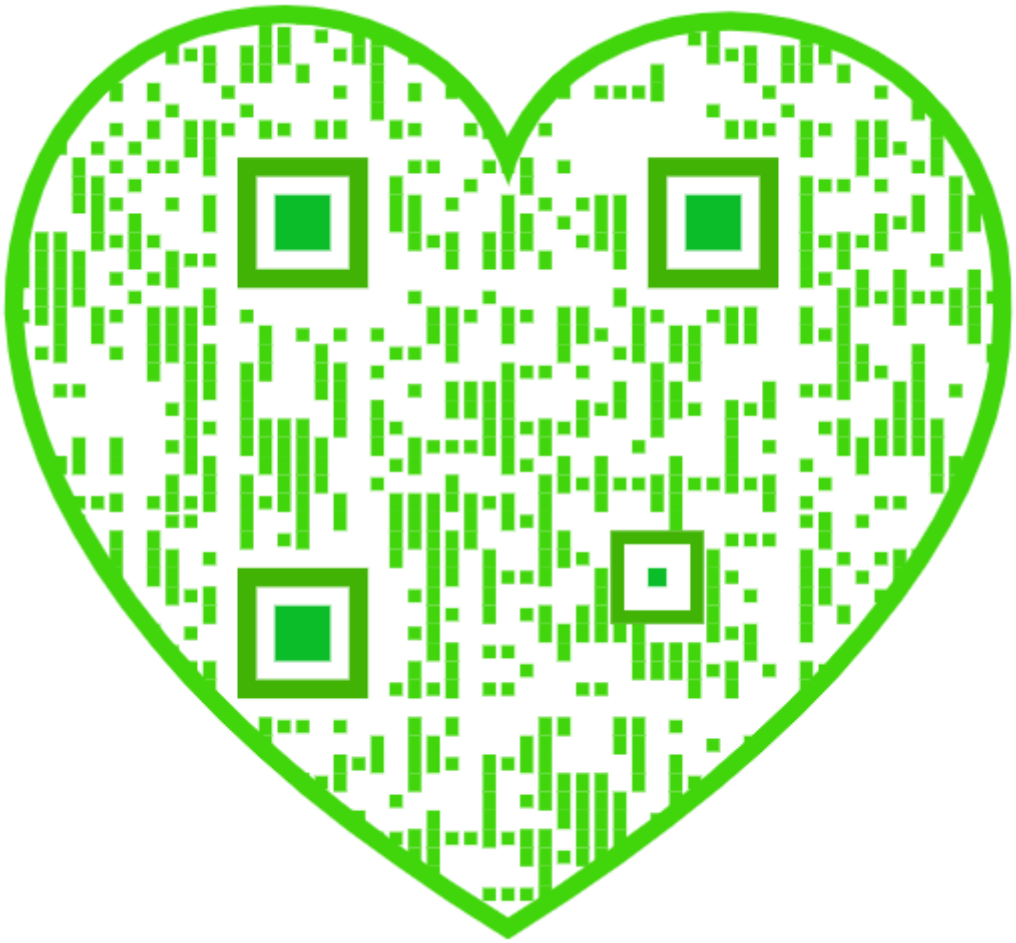
THE AMERICAN HOME ENCYCLOPEDIA



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The Book of a Thousand Startling Wonders

THE

AMERICAN HOME ENCYCLOPEDIA

OF USEFUL KNOWLEDGE

By MARSHALL EVERETT

The Great Descriptive Writer and Historian

A COMPLETE LIBRARY OF UNIVERSAL KNOWLEDGE

CONDENSED INTO ONE VOLUME

THE CULMINATION OF CENTURIES OF HUMAN EFFORTS

SHOWING THE NEWEST AND MOST WONDERFUL INVENTIONS

AND THE

WORLD'S GREAT PROGRESS IN SCIENCE AND COMMERCE

The Great Industries of the World Photographed and Explained

Showing the Wonderful Mechanical Methods of this Century

INCLUDING A COMPLETE INDEX AND A VALUABLE LIST OF REVIEW QUESTIONS FOR HOME STUDY

Superbly Illustrated with a Vast Number of Engravings

MADE FROM PHOTOGRAPHS. EXPLAINING AND BEAUTIFYING THE TEXT.

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PREFACE

By BISHOP SAMUEL FALLOWS, D.D., LL.D.

It has been a great pleasure to me to look over very carefully the pages of this deeply interesting volume. It is a book more fascinating than the Arabian Nights Entertainment. The wonderful inventions, the marvelous discoveries which make the nineteenth and twentieth centuries peerless in all the ages, are here strikingly and accurately presented. No field of modern research has been neglected, and no arena of activity overlooked by the Author in gathering facts for this unique and comprehensive volume. The questions which are continually arising as new and startling revelations are being constantly made in the world of nature and the realm of science are luminously answered. Their application to practical life is clearly set forth. The reader or student will find himself therefore abreast of the times in the possession of the widely diversified knowledge this cyclopedia unfolds.

The useful and the beautiful are happily combined in the subjects presented, for the illustrations are superior works of art and vividly portray to the eye the meaning of the text.

The Index and Review Questions add special interest to the book and make it valuable both for the purpose of study and recreation.

I therefore cordially commend it to the twentieth century man or woman or boy or girl eager to acquire the greatest amount of useful information with the least expenditure of time in gaining it.

SAMUEL FALLOWS.

PREFACE

OF ALL the books ever made I believe this one contains by far the greatest amount of Practical Knowledge ever condensed into one volume. No busy man, woman or child can look at a single page without finding something that will both interest and instruct. Here are the Wonderful Inventions and Strange Devices of Mankind Explained and Photographed so that any one will understand at a glance. No field of modern research has been left untouched, no arena of activity has been neglected, no portion of the globe has been overlooked or forgotten when gathering facts for this, the most concise and yet comprehensive work ever offered to the public.

It sets before the reader in a nutshell all the important and wonderful inventions of all people and all the great discoveries of all nations In the shop, on the railroad, in the store, on the farm, in the factory, in the home, in the school, and amid the whirl of mighty machinery, questions constantly confront us, all of which are answered in this volume and the answers can readily be found by the complete index.

I have never seen such a wealth of useful pictures in one volume before—the publishers have certainly gone to an unusual large expense in making illustrations.

The publishers of this magnificent volume have spared no expense to present to the intelligent reading public a comprehensive and thoroughly up-to-date encyclopædia of the latest inventions and improvements in the scientific and mechanical world; the work is primarily intended for busy people who desire facts, yet who wish to be spared the labor of long and unsatisfactory researches through libraries, museums, and histories.

In the space allotted to science in this delightful book are described the latest marvels: liquid air, the wireless telegraph, the new uses of the X Ray, the advance in experiments toward the perfect air ship, telegraphing pictures, and many other wonderful feats never before dreamed of.

There are a large number of very interesting accounts of inventions along the mechanical line, many partake of the nature of the scientific. Here the reader learns that the dreams of Jules Verne have come true, and that man may now safely travel the bottom of the sea. Besides submarine boats, there are here treated such subjects as battleships and modern war engines, moving pictures, great engineering feats, automobiles, bridges, canals, monster printing presses, type-setting machines, iron and steel mills and foundries and stereotyping processes.

I believe this volume will be of great practical benefit to all who use it.

MARSHALL EVERETT.

INDEX AND REVIEW QUESTIONS FOR HOME STUDY

An Easy Method of "Posting" on Any Given Subject

THE following series of questions pertaining to the subjects treated in this volume is intended as a key to help unlock the great fund of information stored within its pages and to impress that information upon the mind. The list contains inquiries which point toward every quarter of human research and human achievement. It covers the universe, and touches all things which are wont to attract the attention and engross the minds of readers and thinkers.

As we stated in the introduction, the book itself is a compendium of knowledge prepared for the twentieth-century man or woman who is too busy to wade through dense volumes, in order to obtain facts and figures that are here presented in a nutshell.

In daily business and social intercourse, all persons are at times confronted by problems requiring immediate solution. To aid in readily solving them, these questions are formulated and the responses indicated. They will be found to meet the constantly recurring needs of men and women in every vocation, serving as a medium of ready reference, not only to the student and the teacher, but to the mechanic, the farmer, the artist, the railroader, the clerk, the housekeeper, the sportsman, the speculator, the clergyman, the inventor, and all seekers for useful knowledge.

The asking and the answering of these questions will be a benefit to all members around the evening fireside, and prove a welcome and unique entertainment at social gatherings, where knowledge as well as pleasure is the object in view.

QUESTIONS AND ANSWERS.

AIRSHIPS.

Questions	*Answers Page*	*Questions*	*Answers Page*
Whose airship was recently tested with success?	49	Is a flying machine more dangerous than a bicycle?	126
Who were the main performers at the opening of the Chicago Aero Club?	79	What country is in advance of others in aerial navigation?	134

AUTOMOBILES.

How is the under side of an automobile inspected?	34	How can an automobile engine be clean while coasting?	56
Is the speed of 120 miles an hour possible for an automobile?	35	Where was an amphibious automobile recently tested?	72

AUTOMOBILES—Continued.

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What will be the increase of the United States Navy?	86
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BRIDGES.

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How long is the largest trolley line bridge in the world?	40
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TELEPHONES.

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What is the longest distance the human voice has ever been transmitted?	138
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How can privacy be attained on party telephone wires?	241

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Of what construction is the Burger subsurface torpedo boat?	41
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Of what is a mountain climbing sled made?	46
Where are horseshoes made of asbestos used?	63
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Questions	*Answers Page*	*Questions*	*Answers Page*
What is the latest method of washing vehicles?	55	Where is the cart actually used before the horse?	223

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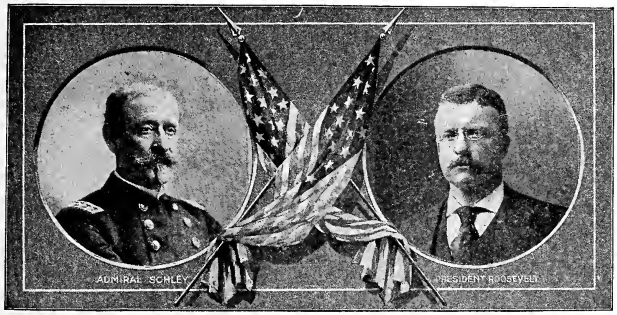
What navy leads the world?	82	What was the most terrific discharge ever made by eight-inch guns?	305
To what is special attention given in the French Navy?	85	How are soldiers identified by finger prints?	319

WIRELESS TELEGRAPHY.

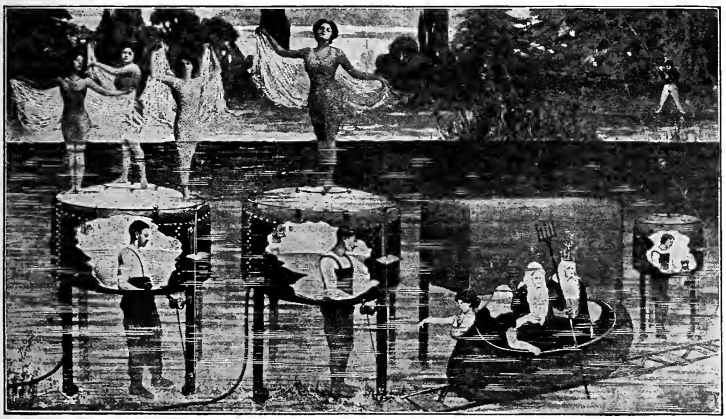
What is the record for wireless telegraphy?	197	Do motor cars make good wireless stations?	240



DIVING BELLS FOR MODERN MERMAIDS

How the Performers are Able to Remain under Water without Drowning

Spectators who have witnessed the mermaid act have been greatly puzzled to understand how the performers were able to remain under water a much longer period of time than a person could possibly hold his breath. The London Sketch tells how it is done, as follows: The principle is well shown by our combination of drawing and photograph. Each mermaid (or, in some cases, each set of two or three mermaids) has her own diving-bell. Before the curtain rises the mermaids take their stand under the diving bells, which are then lowered into the water. When the time comes for a mermaid to rise to the surface she holds her breath, ducks under the edge of the bell, rests a foot on the small platform shown at the side of the bell, and is raised to the surface by the attendant in the bell.

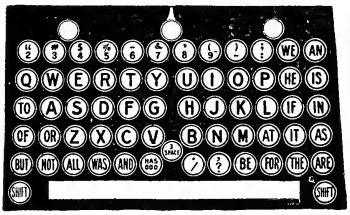


No Illusion, but Live Mermaids and Real Water

There is a special bell, also, for Father Neptune, his boat, and his party, and a small bell from which the comic man of the company catches a live dog at the end of his fishing line. The working of the device is easily illustrated. Take a glass tumbler and plunge it into the water, with the mouth perpendicularly down. It will be found that very little water will rise in the tumbler; but as air is compressible, it could not entirely exclude the water, which by its pressure condenses the air a little. The bells are made of boiler-plate, and have air-hose connections, telephone, and electric light. The mermaids are protected from cold by rubber under-garments, and their grease-paints are waterproof. Directions to the performers are given by telephone and by red and green signal lights. Many have thought the scene an illusion produced by an arrangement of mirrors; this should enlighten them.

TYPEWRITER WRITES WORDS AT SINGLE STROKE

A new typewriter will soon be put on the market which will write a complete word at one stroke. Twenty-two of the

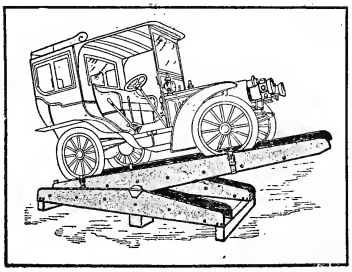


The Keyboard

short words most used in correspondence have been chosen, as indicated on the word-keys of the cut of the keyboard. The carriage shifts automatically by touching the proper key, and the platen revolves either forward or back in the same manner.

AUTO INSPECTION DEVICE

For purposes of repair or inspection, or for display in salesrooms, a Frenchman has invented the device illustrated. In operation the frame is secured with the long end on the floor. The car is run on, made secure, and a fastening released which allows the tilting frame and the car to tip as shown. The wheels run in a trough to allow an unobstructed view of the under side of the car.



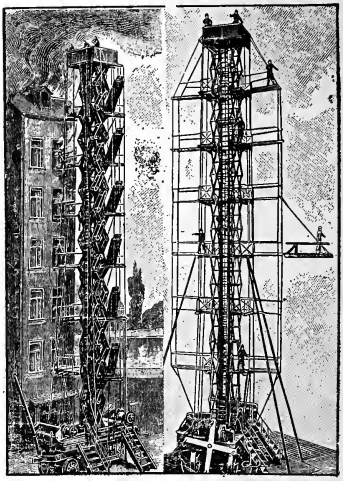
Handy for Repairs

A NEW FIRE TOWER

One of the latest inventions for fighting fire is the tower shown in the illustrations. The apparatus is mounted upon a car which can be used as an automobile or drawn by horses. Each pair of wheels has an independent steering device and their own motor, while a third motor is used to raise or lower the tower. Electricity is supplied by storage batteries.

The tower is built upon the principle of the accordion and can also be operated by hand, if necessary. The platform on top has flying bridges which are thrown out on either side to the various stories of a burning building.

A nozzle is placed on the upper platform. It has a flexible connection with the ground and if the force from the water mains is not sufficient the truck has a special pump, operated by a motor, to raise the pressure as desired.

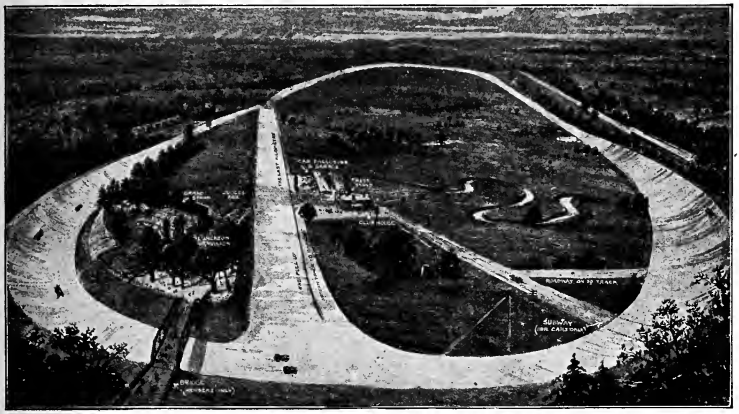


Life-Saving Tower

The tower makes a very compact body when it is collapsed. Outriggers on the base prevent any danger from top-heaviness when the apparatus is extended to its full height.

MOST WONDERFUL RACE TRACK EVER BUILT

Speed of 120 Miles an Hour Possible—1,581 Miles in 1,440 Minutes Already Scored



The Great Race Course at Weybridge Station

Nothing in the way of a race course of ancient or modern times approaches the great autodrome of the Brookland, Eng., Automobile Racing Club. It is built to accommodate a speed of 120 miles an hour, and already S. F. Edge has a record of 1,581 miles in 1,440 minutes—24 hours—or an average speed of about 66 miles an hour.

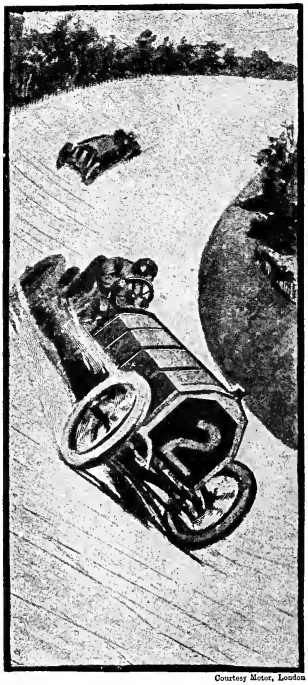
This track is 2¾ miles long, 100 ft. wide, and at the curves raised to an ovaloid shape 28 ft. high. The entire course is covered with concrete 6 in. thick, in the making of which 200,000 tons of sand, gravel and cement were mixed. In the building 30 acres of forest were removed, a hill 50 ft. high and 700 ft. long dug away, and a river turned from its course. Seven miles of temporary railroad and 6 locomotives were required during the nine months of construction which cost $750,000.

Grand stand seats on a hill within the inclosure will seat 30,000 people, and outside there is standing room for nearly a quarter of a million spectators. To protect them a double row of hand rails, 15 ft. apart, extend around the track; between the rails policemen are stationed at frequent intervals. Electric signal boxes with sentries are located each 900 ft. No one can cross the track; visitors enter over a bridge, and automobiles through a subway. There are 28 large garages in the grounds.

The most powerful and fastest cars will be carried highest at the curves, at which moment the occupants will be nearly horizontal to the earth; the movement of the cars being similar to a pea rolled rapidly around in a bowl.

Commenting on the possibilities of the future the Motor Age says editorially: "Modern railroad locomotives have been, so far as speed is concerned, placed in not better than second place, and by the motor car. Imagine one car traveling continuously for 24 hours at an average speed of 66 miles an hour, and this on a circular track! What might be expected of this same monster were it to be turned loose on such a track as is furnished the locomotive? A railroad promoting company has

boasted it will carry passengers between New York and Chicago in 10 hours and has been laughed at for making such a wild statement. It is neither



Courtesy Motor, London

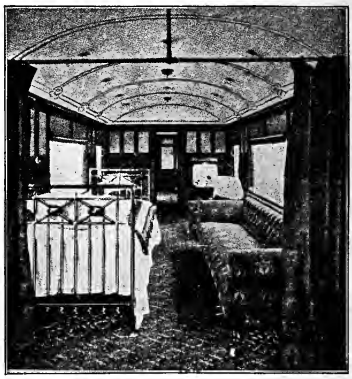
Taking the Curve

impossible nor improbable; it will happen within a very short time. It is not likely steam will be the motive power—it will be a fight between the adherents of electric motors and those of internal combustion motors, with odds favoring the latter."

An average of 400 ft., board measure, of lumber, per capita, is used in this country against a European average of but 60 ft. Moreover, practically 75% of the cubic contents of a tree is lost in logging and in failure to adapt board lengths to the peculiarities of the tree rather than arbitrary rules of the trade.

ENGLISH FAMILY CAR

One of the English railroads has put in service new special cars for family use. These cars are 50 ft. long with a private baggage room at one end. The interior finish is expensive with



Like a Home Parlor

very handsome effects. One compartment has a regulation bedstead, which in case of illness can be suspended to reduce the jar.

Lanterns Mark the Course at Night

DARING WORK OF STEEPLEJACK

Rides to Work on Wire Rope 200 Ft. in Air

A Philadelphia plant has a brick stack that was until recently topped by a 2-ton metal cap in eight sections. It became so corroded that it was necessary to remove it. The stack is 13 ft. in diameter at the top and flares out. The only way to get to it was by passing through a 65-ft. underground flue to the interior of the stack, and then scaffolding up. This flue was so filled with soot and gases, that John Hassler and his assistant, who did the work, were twice nearly overcome as they carried in lumber for the scaffold.

After the steeplejacks reached the top they rigged up a tackle which connected with an iron chimney 200 ft. high and 75 ft. away. Access was had to the iron stack by an outside ladder and it was then an easy matter to transfer material and themselves.

THE CATALPA AS A LUMBER TREE

The catalpa was esteemed very highly by the Indians and old settlers of Indiana. The former traveled hundreds of miles to obtain the logs for their canoes. They were light, durable, easily worked, and did not crack or check with alternate wet and dry conditions.

The settlers used it for various purposes, in fact for almost everything, always taking it in preference to oak, walnut or ash. Plow-beams, hay frames, ladders, windmills and fences were all made of it. Early railroads used it for telegraph poles and it gave exceptional satisfaction, so much so, in fact, that the natural supply was soon exhausted. Efforts are being made to plant extensive forests of catalpa. Here are some of the things it does:

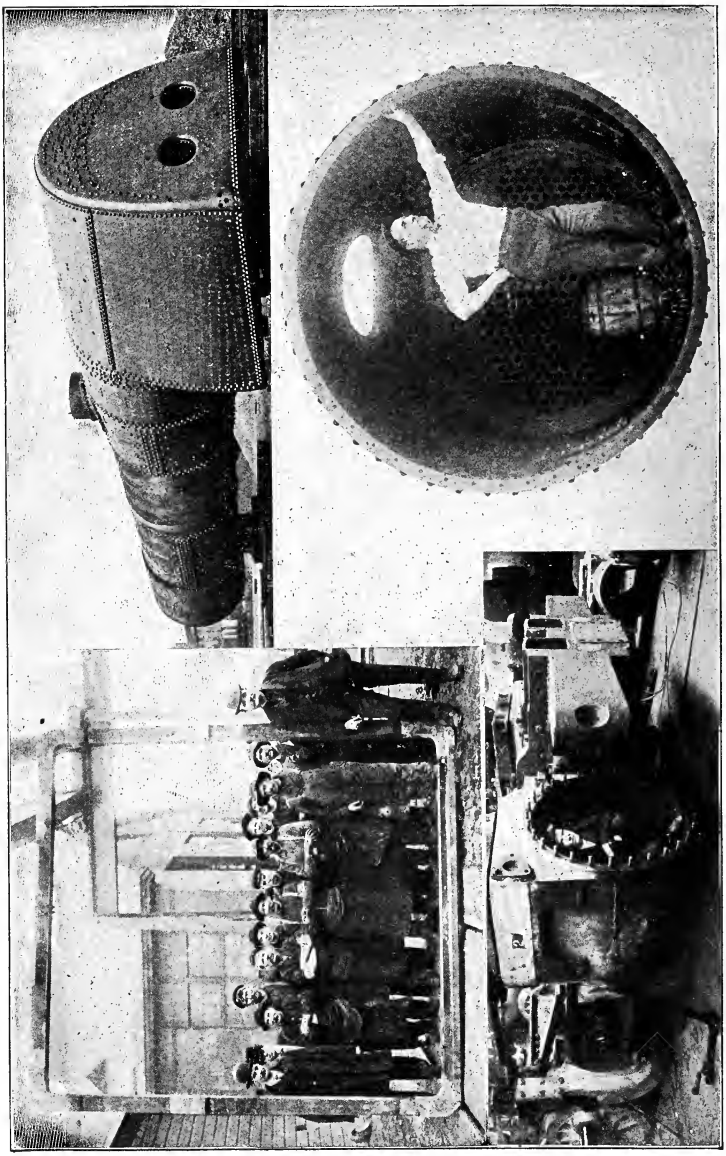
In 20 years grows 40 ft. high and 20 in. thick; in 50 years, 100 ft. high and 30 in. thick.

As fence posts it lasts 85 years; as railroad tie has lasted 32 years. In 12 years grows large enough for a telegraph pole. Makes excellent furniture, and book paper. An oak takes 12 times as long to grow and lasts only half as long in ground.

For a few hundred dollars a young man can buy cheap land and plant it with catalpa, which will be worth thousands of dollars by the time he is 45 years old.

PUMPED CARGO INTO THE SEA

The crew of a San Francisco tank steamer, carrying oil, imbibed too freely and became inebriated. Thinking to pump out the bilge water in the hold, they started what they thought were the bilge pumps, but which in reality were the ones which emptied the tanks, and as a result 5,000 bbl., or about 200,000 gal., of California oil were wasted.



HEAVIEST LOCOMOTIVE EVER BUILT

Will Haul a Train of Cars Two Miles Long, on Level Track

The interest of the locomotive world is at present centered in the three articulated compound locomotives now building at the Schenectady works of the American Locomotive Co. for the Erie railroad. These engines will be the heaviest and most powerful locomotives ever built and will break all records in locomotive construction. They are of the type known as the Mallet compound and will have sixteen driving-wheels, arranged in two independent groups of eight each. The high-pressure cylinders which are 25 in. in diameter by 28 in. stroke drive on the rear group of driving-wheels, and the low-pressure cylinders which are 39 in. in diameter by the same stroke drive on the forward group of wheels. The four rear pairs of wheels are arranged in frames which are rigidly attached to the boiler. The forward four pair of drivers are, however, carried in frames which are not rigidly connected to the barrel of the boiler, but which are in fact a truck; this truck swivels radially from a center pin located just in advance of the high-pressure cylinders.

The locomotive alone without tender will weigh 205 tons, and will haul on the level 320 loaded freight cars, or a train about two miles long. In the accompanying photographs are shown the boiler and firebox foundation ring and low-pressure cylinders of these immense machines. The boiler is over 43 ft. long and the inside diameter of the largest ring is 8 ft. It is provided with 404 tubes $2\frac{1}{4}$ in. in diameter, and 21 ft. long. The water alone in the boiler will weigh 42,700 lb., and the tubes weigh 23,700 lb. The firebox of this boiler would make a good-sized living room, being $10\frac{1}{2}$ ft. long and $9\frac{1}{2}$ ft. wide inside, and having a grate area of 100 sq. ft. The man standing at the right in the illustration of the firebox foundation ring is 6 ft. 3 in. tall, which gives a good idea of the immense proportions of the ring itself.

The first example of this type of locomotive in this country was the Mallet compound built by the same company for the B. & O. in 1904. This engine astounded the locomotive world at that time by its enormous size, but these engines for the Erie railroad will be as much heavier than their predecessor as that engine was than the largest locomotive of its time. The decided success of the Baltimore & Ohio engine, however, has proved the advantages offered by this type for exceptional weight and hauling power, and justifies this still greater development of the type.

These engines will be completed about the middle of next month and will be watched with interest by the whole railroad world.

COST OF COOKING BY VARIOUS MEANS

Tests made by cooking meat for one hour gave results for five different methods, as shown in the accompanying table:

Electricity, per hour	4.128 cts.
Coal, per hour	3.675 cts.
Gas, per hour	2.000 cts.
Gasoline, per hour	1.248 cts.
Kerosene, per hour	1.092 cts.

An investigation of the table shows that electricity would cost twice as much as gas. In most localities, however, the unit cost of electricity would be higher. Also the prices of gasoline and kerosene are very low for a good many places. It is usually considered that cooking by coal is cheaper than by gas.

The advantages of electric cooking are that there are no ashes, smoke, or soot, very little heat and no danger of explosion.

NEW METHOD OF REVIVING THE DROWNED

Surgeon Claims to Resuscitate Bodies which Have Been Six Hours under Water

If the discovery by Dr. H. K. Whitford, of Elgin, Ill., proves to be what he predicts, hundreds of lives will be saved every year. He declares he is able to revive human life after it has been submerged in water up to six hours.

The theory advanced by Dr. Whitford, and deemed not an illogical one by physicians, is an entirely new one. In speaking of his method, he says:

"It is impossible for a drop of water to enter the lungs of a person who enters the water alive. This is in contradiction to the time honored belief that the lungs of a drowned person are filled with water.

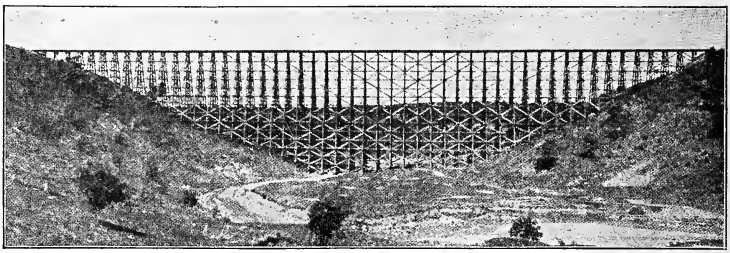
"The water striking the larynx causes a spasm which closes the lungs, and prevents the entrance of water for a period of nine days, until relaxation commences. Drowning, so called, is merely suspended animation, and not death.

"To restore animation I proceed first to thoroughly warm the body chilled by long submersion. This is accomplished with hot water, in which the subject is immersed for 20 minutes or longer. Following this, the old and ordinary methods of restoration are resorted to."

This process, he says, makes possible the saving of lives of persons who have been submerged for a time—not exceeding six hours. Dr. Whitford claims never to have failed in his method of resuscitation, and believes that it will be adopted universally.

There were over 300 deaths from drowning in this country from January to July 10, and before the snow flies this number will be almost doubled.

ELECTRIC RAILWAY BRIDGE 800 FT. LONG

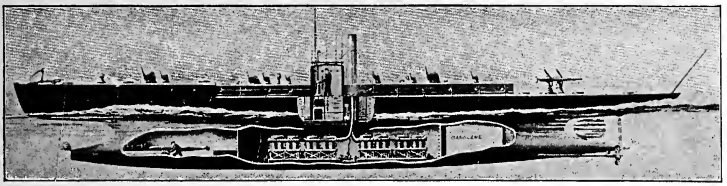


Largest Trolley Line Bridge Yet Constructed

The interurban electric railways are not only competing with the big steam roads, but are building tracks and bridges which formerly were attempted only by "railroads." An instance of this is seen in the illustration of the largest trolley line bridge yet constructed. This trestle crosses a deep ravine near Boone, Iowa, and is 165 ft. high and 800 ft. long. It is also unusual, in these days, being made of timber.

Another interesting feature is the fuel supply. The power house is built over a coal mine.

The United States will build two battleships, each 3,000 tons heavier than any afloat, and to cost $10,000,000 each.



NEW TORPEDO BOAT

"Waterclad" Subsurface Craft—Not a Submarine

A strange new fighting craft, the Burger subsurface torpedo boat, was tested by the Construction Board of the United States Navy. Neither submarine nor surface vessel, it is a combination of both. There are two distinct hulls connected by a "waist," with the engines, steering gear, torpedoes and torpedo tubes beneath the surface, out of sight and out of the reach of shot and shell.

Unlike a submarine, it will be able to go to sea alone, to hold a steady vision of the enemy, and to maintain a high speed—as great as 20 knots an hour. Unlike a torpedo boat, it has the quality of invulnerability, for all the "vitals" are nearly 5 ft. under the water line. The craft has been called a "waterclad."

The conning tower is the only vulnerable part when the boat is in action. It is covered with Krupp armor 4½ in. thick, which furnishes protection against small rapid-fire guns. This tower is too small to be hit by the big guns except through chance.

The upper hull, the one that lies on the top of the water, is in effect a float, and is divided into separate compartments filled with cellulose. If a shell should go through one of the compartments the cellulose would expand at once and fill the hole, for that is the principal characteristic of the substance—no sooner does it become moist than it begins to swell.

In the heavily armored conning tower are the steering wheel and the signals to the engine and torpedo room. Through the tower rises the main air shaft terminating in a stack, through which foul air and stray gasoline vapors may escape. Fresh air for ventilation and engine combustion is taken in through openings in the tower when the boat is in action. The exhaust for the engines is led up into the air stack. An armored ammunition hoist leads upward from magazine to after deck.

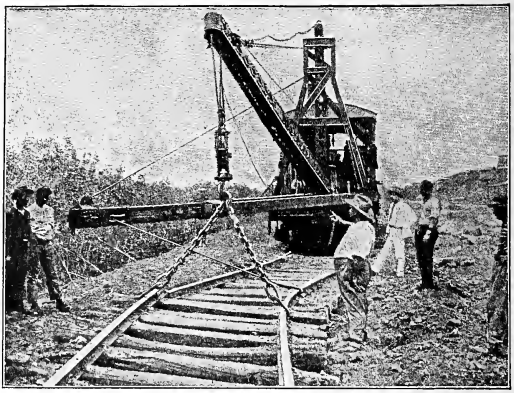
The offensive armament consists of a bow torpedo tube with three 21-in. torpedoes having a range of from 3,500 to 5,000 yd. and a speed of 35 knots. The torpedoes are discharged from the tube 13 ft. below the water surface. Two rapid fire guns on the upper deck serve to keep hostile torpedo boats and destroyers at a distance.

When the subsurface boat is not in action the upper hull will afford the usual conveniences for stowing boats and anchors, and for exercising the crew. Amidships, between the cellulose compartments on the sides, are arranged comfortable quarters for the officers and crew. Thus when fighting is not in progress the subsurface boat is much like any other. When the danger zone is approached, however, the crew get into the submerged hull. Then the greater part of the upper, or exposed, hull could be shot away without destroying the stability or efficiency of the submerged torpedo boat. The vessel is patented and costs $250,000. Gasoline engines furnish the power.

The latest fad among the wealthy is hand-made cloth. This going back to hand-made goods in cloth, furniture and printing will probably be followed by other reversions.

MOVING A RAILROAD SIDEWAYS

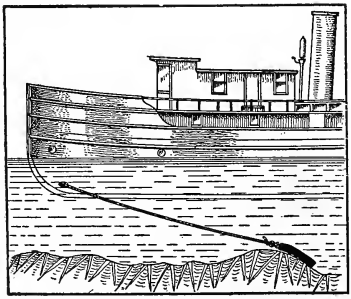
Down on the Panama Canal machinery must be made to relieve hand labor to the utmost, and if no machine is at hand to do the work required, the engineers have to rig up something even though the device is not described in the books. Such a machine is the patented invention of General Manager Bierd, of the Panama railroad. He had occasion to move many miles of track several feet to one side. To do this he rigged up the machine shown in the cut which operates very much like a steam shovel with hooks instead of the shovel. Two lifts are made of each section, one rail length long, with a crew consisting of a foreman, engineer, fireman and four laborers. In 8 hours they move 6,000 ft. of track a distance of 4 ft. sideways at a cost of half a cent a foot.



Moved 6000 Ft. of Track 4 Ft. Sideways in 8 Hours

MACHINE DRAWS MAPS OF OCEAN BOTTOM

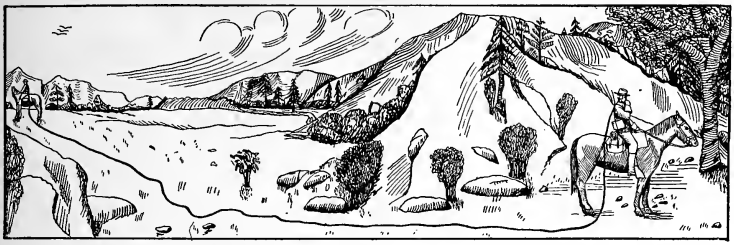
An instrument has recently been invented for recording the depth of water, and which makes a pen record something on the principle of the machine which records the rough places in a railroad track. A slab of metal attached to a rope is dragged over the bottom by a boat moving slowly. The other end of the rope extends over pulleys to the charting room, where a pen records the ups and downs, or peaks and valleys of the bottom, making a topographical map. Experts know how to translate these tracings into feet or fathoms. The results are much more accurate and vastly quicker than the old method of sounding with a hand line.



Records Submarine Elevations

GOLD CARGO; DIDN'T KNOW IT

The captain of the "Ohio" sailed into Seattle with a gold laden cargo when the captain thought he had only sand ballast. The ship was partly wrecked at home, and after temporary repairs had to go to Seattle for docking. Several hundred tons of sand ballast were dredged near Nome and loaded into the hold. On arrival at Seattle its rich gold bearing qualities were accidentally discovered by a dock hand, who panned a shovelful and reported his find.



CAVALRY HORSES USED AS TELEGRAPH WIRES

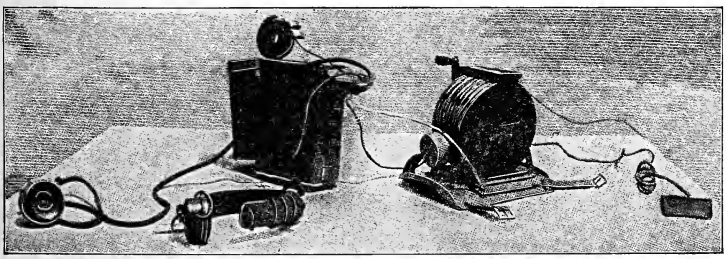
Scout on Horseback Sends Telegrams to Distant Headquarters without Stopping

[The following is condensed from a detailed account by First Lieutenant A. C. Knowles, which appears in the Journal of the U. S. Cavalry Association for July.—Editor.]

The photographs shown herewith illustrate a combined telegraph and telephone system in which the horses are a part of the electrical circuit. The riders are equipped with breast reels, containing five miles of wire, and cavalry buzzers, or instruments for receiving and transmitting messages.

Heretofore when a mounted scout, equipped in this manner, desired to communicate with the main force, or headquarters, it was necessary for him to dismount and establish a connection by driving a metal pin into the ground. This completed a circuit through the line he was reeling out, his instruments, and thence through the earth to the home station. This, however, was very inconvenient, due to the necessity of dismounting. Also it was an impossibility for the station at headquarters to get into communication with the scout except when the latter chose to drive the connecting pin into the earth.

Many experiments were tried, until finally those of Lieutenant Knowles were successful, and a system was evolved which works satisfactorily. When a mounted operator is sent out to accompany a reconnoitering patrol, or any body of troops whose duty takes them far enough away from the main force to make electrical communication desirable, constant connection can be had with them through the rider. It is not necessary for him to dismount to establish a circuit, for he can receive messages even while his horse is on a trot. This enables the officer at headquarters to call the party back after it is several miles away; change the order as to destination; or give any emer-



Buzzer, Head Piece, Transmitter and Breast Reel

gency order which may be necessary. Heretofore a mounted messenger had to follow at full speed to find and overtake the party, with loss of valuable time when each minute counts. To accomplish this the body of the horse is made part of the circuit, by means of a small piece of copper placed next the skin—the hair having been shaved off, and the copper plate connected to the instrument.

New Wireless Outfit

As the horse always has one or more feet upon the ground, except possibly for an instant when galloping, a constant ground connection is obtained through its hoofs. Of the horses used few show any discomfiture at the unusual sensation and those that are restive soon become quieted and accustomed to the tingling, as the current passes through their bodies. The commander of the patrol may ride alongside and dictate a message or take the telephone attachment himself and talk direct with headquarters. All of this can be done on a gallop, while the scouting force moves rapidly ahead.

Tests of this system were made over all kinds of ground—very wet, muddy, moist, perfectly dry and dusty roads and fields—and in all cases the tests were entirely satisfactory. The illustrations show two horses 5 miles apart and standing upon grass. Results were perfect and the receiver could be heard several feet away from the instrument.

The apparatus is very compact, being packed in two small cases and carried over the shoulder like a field-glass. One case contains the telegraphic instruments and dry batteries. The other carries the telephone attachment. The latter is connected by inserting a plug in the first-named case. On starting out the operator pays out an insulated wire which is allowed to fall on the ground. This wire is carried on spools each containing half a mile. On the return, if time and circumstances permit, the wire is rewound on reels fastened to the breast of one of the men.

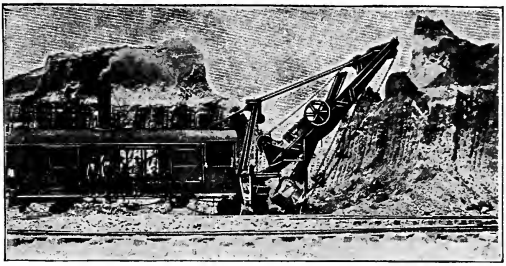
Wireless telegraphy will still play a most important part in field work, and almost the first duty of a signal corps is to set up the apparatus and establish communications after a base has been chosen. As in almost every other phase of army life, the mule has a very important duty in the wireless system, for it is upon his sturdy back that all the apparatus is transported. Recent improvements, however, have reduced the number of mules required to three: One carries the storage batteries, another the operating chest, and the third the extension mast, guys and attenna.

Pearls turned yellow by long wearing may be made white again by placing in a bag with wheat bran and moving them constantly over a coal fire.

The biggest cranberry bog in the world will occupy 500 acres in Massachusetts and will be artificially irrigated.

REMOVED A HILL IN THREE YEARS

A manufacturing concern in Cleveland needed more room in which to build new factories, but a hill 800 ft. long, 500 ft. wide and 100 ft. high stood in the way. It was decided to dig away the hill and a big steam shovel has now finished the job after working for three years. The shovel deposited the dirt into small cars from which it was dumped into scows on the river, and then towed five miles out into the lake and again dumped.



This Machine Dug Away a Hill 800 Feet Long

METAL SHELL FOR BELL

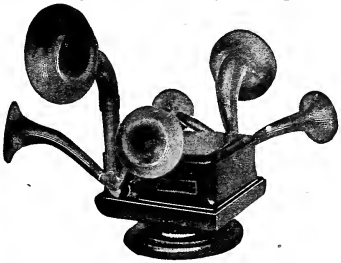
One of the big projectiles intended for the mammoth coast defense guns tested at Sandy Hook, exploded while being transported thither. The metal shell or casing was but little injured, and when the public clock at the fort gave out, the shell was slung up and has been used as a bell ever since.

Ringing the Bell

The sound is a far reaching and peculiar one, quite unlike any ship's bell, and is produced by striking the shell with a piece of hard wood or metal. The bell "pounder" is a negro 80 years old who has been on the retired list some time but who refuses to leave, or allow anyone else to sound the bell.

MECHANICAL TRAIN CALLER

No matter how large a depot may be, the new system of calling the departure



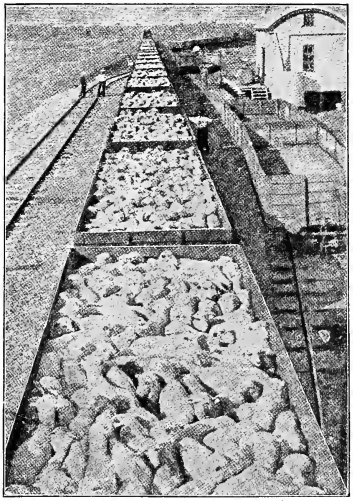
Calls Departure of Trains

of trains announces the fact simultaneously in every part of the building. The instrument, which is called a telegmagnophone, is really a telephone with one transmitter into which the caller speaks, and a large number of receivers connected with horns for magnifying the sound. It is the intention to place the receivers in all the various smoking, restaurant and waiting rooms where passengers congregate.

RAILROAD SAVES STARVING SHEEP

To Do So Abandons All Other Traffic

The Queensland downs of New South Wales are the richest sheep pastures in the world—except when one of the fearful drouths occur, such as happened last year. At that time sheep valued at $10,000,000 were threatened with utter extinction. Owners were in despair and appealed to the Government for help.



Rescued From Famine

A narrow gauge steam railway traverses the district, and was used in saving the flocks. For weeks other traffic was abandoned, and everything in the shape of a car was pressed into service. As there was water at one end of the line, wooden tanks were built as fast as possible, placed on cars, filled, and kept moving constantly, carrying water all along the line. The sheep quickly learned that the sound of a locomotive whistle meant renewed life, and hundreds were killed beneath the wheels in their irresistible rush for the water train. Hundreds of tons of molasses and sugar cane tops were shipped in to relieve the famine until the herds could be removed.

The sheep were brought out of the district in freight cars of every description. Thousands were too weak to walk and had to be lifted aboard by men. Once on a train it was rushed to destinations where there were water and feed.

During the few months of drouth more than 1,000,000 sheep, 7,000 horses and 6,600 cattle were carried on the little road. In all the history of railroading there never was an instance where a line was given up to work of this kind exclusively for so long a period.

MOUNTAIN CLIMBING SLED IN SWITZERLAND

There has been introduced in the Swiss mountains, for use during winter months, a mountain climbing sled, which is proving as convenient as the bicycle on level ground. The sled consists of two bobs and is propelled by pedals and gears and a sharp toothed wheel which is forced down into the hard snow of a path. The general construction requires no detailed explanation. Any person handy with tools can build one out of two worn out bicycles, and for use on frozen rivers, ponds or lakes it will be found capable of high speed.

Propelled Like a Bicycle

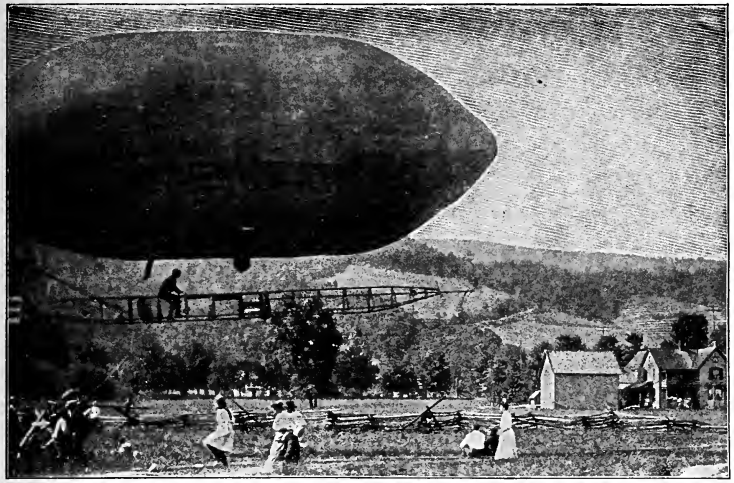
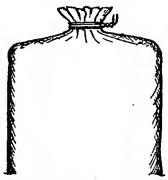


Photo Courtesy Curtiss Mfg. Co.

The above illustration shows Capt. T. S. Baldwin's airship starting on its flight near Hammondsport, N. Y. The gasbag is 52 ft. long and 17 ft. in diameter. The frame is 42 ft. long and 3 ft. high. This flight lasted 30 minutes, during which the ship rose to a height of 3,000 ft. and maneuvered successfully, alighting within a few feet of the starting place. The test was watched by prominent officers of the army.

TYING SACKS WITH WIRE

Millers are finding they can save time by tying sacks with a piece of wire instead of twine. The American Miller tells how to do the tying:

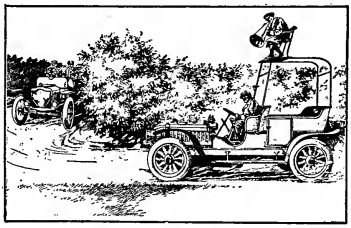


"Wrap the wire around the mouth of the sack twice, being careful to bring the second wrap so as to be below the first, in order to prevent slipping; then twist the ends of the wire twice, cutting the wire and bending upward, and the sack is tied. This can easily and quickly be done with the fingers and will excel all other ties and is easily untied."

"The public be," no not —— but "informed" regarding all accidents hereafter. That is the latest order on the Harriman lines.

LOOK-OUT MAN FOR AUTOS

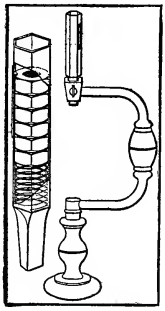
Owners of motorcars are experiencing trouble in England, owing to the many sharp turns in the road which are concealed by tall hedges. The effort to have the hedges cut down has raised



"Car on your Starboard Bow, Sir"

a storm of protest. The editor of Motor, London, facetiously suggests a look-out man on the car, preferably an old sailor, and pictures him as announcing through a megaphone "Car on your starboard bow, sir."

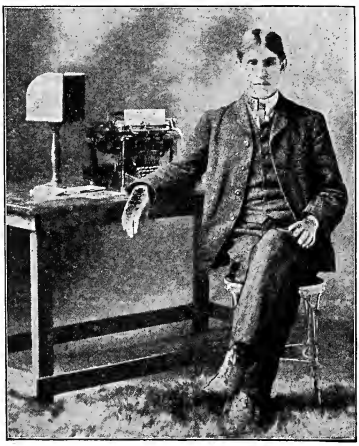
MAGAZINE WRENCH



For rapid work in changing tires during an automobile race the tool illustrated is used in France The tool is nothing more than a socket wrench with sufficient length to hold the number of nuts necessary for one rim and with a shank made to fit any brace. As the nuts are received one by one they compress a helical spring in the bottom, and are retained by an automatic spring catch at the side, of the tool. Each time the spring catch is released a nut is ready for service.

BLIND OPERATOR EXPERT TELEGRAPHER

Gilbert McDonald, of Maunie, Ill., occupies a unique position in the field of telegraphy. Blind since birth, he has nevertheless so perfected himself in the art, that he is a skilled operator, and is thought to be the only one in the world in active service.



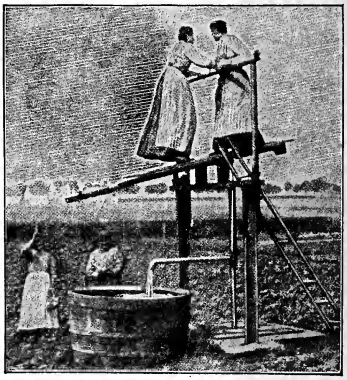
Blind Since Birth, Expert Telegrapher

When he was 12 years old he commenced to study the telegraph. His use of the code language was limited and to overcome this he wrote long lists of words on the typewriter, as they came over the wire. In the evenings his sisters would teach him the meanings of these words. Thus he enlarged his vocabulary to over 2,000 words.

McDonald uses the typewriter with dispatch, and when working the telegraph key can send over 40 words per minute, using either hand. He is assistant station agent, performing the usual duties of that position and weighing baggage by the sense of touch. He recently refused the post of instructor of telegraphy at the Illinois state school for the blind.

TILTING-BOARD PUMP

The tilting-board pump is a familiar sight in those parts of Bavaria where



Teeter-Totter Pumps the Water

irrigation is employed. The pumpers stand face to face holding on to a cross bar, and by shifting their position, forward and back, cause the pump rod to work up and down. The movement should be regular to obtain the best results.

TRACTION ENGINES IN AFRICAN JUNGLES

Worshiped by the Natives as Fire-Gods—Great Mining Operations Impossible without these Trackless Trains

Assembling a Traction Engine in the Jungle

In no savage land has such a magical change been wrought, mechanically as well as socially, as in West Africa, the land of fevers, wild beasts, treacherous natives—and golden reefs and streams. It is only quite recently that King Prempeh sat on his golden stool in Coomassie, the capital of Ashantee, and paved his palace yard with human skulls.

He massacred with every circumstance of horror, several white missionaries and traders, and the British sent an expedition against him. After a long and costly struggle, the bloodthirsty tyrant was overthrown and the whole territory of Ashantee thrown open to the gold-seekers.

Last year over fifty million dollars' worth of bullion and dust was taken out of this region under circumstances that well illustrate the romance of gold hunting. Be it remembered that Ashantee is hundreds of miles inland from the West Coast of Africa, and Coomassie is fenced in with hundreds of miles of pestiferous jungles, and fever-haunted swamps, from which at dusk rise white steamy vapors, laden with death for the white man.

But the greatest problem of all has been that of transport. Pioneers saw that every little forest stream fairly ran with gold, and it seemed such an easy matter to pick up a fortune. Labor, however, was not to be had, for the West African savage is lazier than any other, doubtless by reason of the terrible climate. Soon the labor question became gravely critical, because

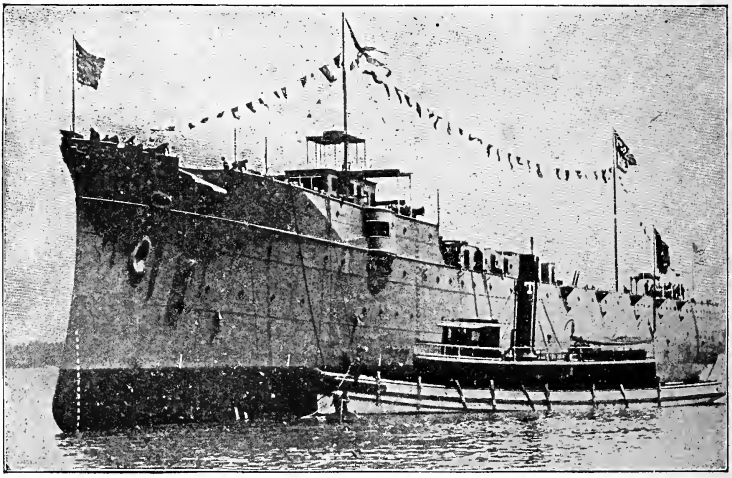
great corporations began to establish vast and costly plants in Ashantee.

The wilderness had to be cleared and kept cleared. For in these luxuriant wilds a clearing of this month becomes a jungle the month following. And yet, despite all adverse conditions, West Africa grew in importance as a gold producer. The greatest problem of all was the question of transporting supplies from big steamers on the coast into the heart of this most difficult of countries. There was nothing for it, after many experiments with great trains of coolies who were paid fantastic wages, but to import broad-wheeled traction engines which, however, had to be built in convenient sections, so that they might be borne through the tremendous West African forests in man-carried loads.

All these would be dumped down near the great mines, and then put together by natives under the superintendence of white engineers. The first engine, when set in motion was worshiped as a god for hundreds of miles around, mainly by reason of its great strength. Soon passable roads were cut through the wilderness from the coast, and big trains of broad-wheeled wagons passed to and fro carrying machinery, clothing, tools, provisions and a hundred and one necessaries for the thousands of white men now employed in West Africa's interior.

For besides gold there are other treasures in the shape of mahogany and teak forests, not to mention great deposits of tin. The traction engines, therefore, have solved the problem of West Africa's development and enabled many struggling properties to tide over their bad days.

NEW TYPE U. S. CRUISERS



The Birmingham Immediately after Launching

The latest type of United States cruisers, of which the "Chester," "Salem" and "Birmingham" are under construction, is seen in the illustration, which shows the "Birmingham" immediately after launching. These sister ships will use turbine engines and are planned to be the fastest in our Navy.

FIRE DEPARTMENT WORK ON JULY FOURTH

Many fire departments have a special call assignment for companies during the 24 hours of July 4th. The system has been a success where it has been tried, and when properly planned and executed it has reduced the number of useless runs, besides always keeping heavily populated districts well protected with reserve companies.

When a first alarm is sounded, only a portion of the usual quota of engines respond unless the commanding officer rings for others. A second call brings the remainder of the companies which ordinarily would respond to a first alarm. A third call brings the teams which usually respond to a second alarm; a fourth call brings the third alarm teams, etc. If the fire grows to large proportions, the second and sometimes the third call is omitted, and the third or fourth alarm, as the case may be, sounded direct.

The average Fourth of July fire is usually a small matter, and as a rule a single chemical engine is sufficient to extinguish it. The alarm system described meets the emergency with one or two engines and saves the others from unnecessary hard runs.

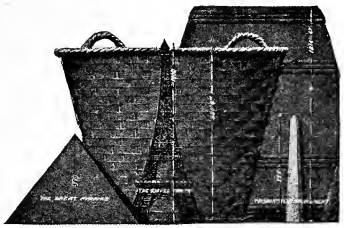
SUPREMACY OF WHITE BREAD

White bread is rapidly becoming the bread of the entire civilized world, and its use is increasing every year. Milling, a Liverpool journal, says:

The change is becoming more pronounced every year, but as the wheat production in the rye-consuming countries does not increase pro rata, it is throwing more demand on wheat from other growers. In the Far East the tendency to replace rice by wheat is another instance of the triumph of the latter. As knowledge grows dietary customs give place to more enlightened foods. Growers of rice and rye will become wheat producers, but probably not as fast as the consumers change from one to the other food.

GRAPHIC ILLUSTRATION OF U. S. WHEAT CROP

The wheat crop of the United States last year was 735,261,970 bu., a quantity difficult to comprehend. The Scientific American has made a graphic illustration of this by an imaginary basket 792 ft. in diameter at

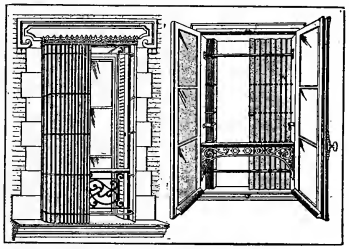


Wheat Pile 980 Ft. High

the bottom, 1,225 ft. at the top, and 980 ft. high; or about as high as the Eiffel tower. If made into flour a barrel 1,214½ ft. high and 962½ ft. at the widest part would be needed to hold it.

VERTICAL SLIDING WINDOW BLINDS

A novelty in the construction of window blinds for residences or office buildings comes from France. The blind is composed of vertical slats

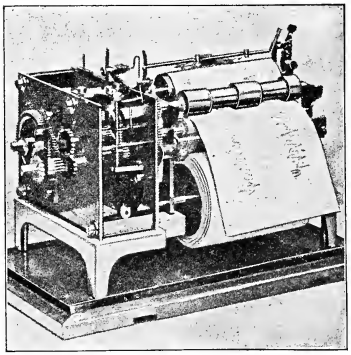


The Shutters Move Sideways

which are carried on two horizontal rods, and open and close by sliding toward or from the middle of the window. The slats remain in the position to which they are moved leaving an opening of any desired size.

MACHINE RECORDS ROUGH TRACK

A machine which when carried on a locomotive or car records the rough places in the track has enabled the Japanese narrow gauge railroads to increase the speed of trains from 24 to 35 miles an hour. The machine is



Pen Picture of the Jolts

not unlike the seismograph, which records the length and severity of earthquakes. When used on a railroad it records the place and "size" of the jolt caused by bad joints in the rails or other uneven conditions. The Japanese have even been able to locate soft ties in the track, which had escaped the inspectors.

These instruments are very expensive, being made at only one place in the world, and then only on special order. In size it is only 10 by 12 by 18 in., and weighs 33 lb. So sensitive is the instrument that on being drawn across an apparently smooth floor, it records the nailheads and knots in the wood. The record is made on a sheet of paper which unwinds from a roll, and is written with ink by a sapphire pointed pen. Several of the recorders are in use in Europe and a road in this country has ordered one.

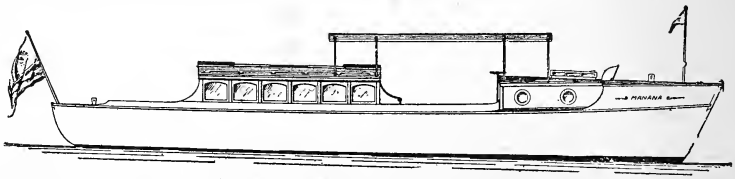
CEMENT AS METAL PRESERVATIVE

The preservative qualities of cement have been well demonstrated in maritime work during the past few months. The larger vessels on the Pacific coast have a coating of fine cement on the inside steel plates of the hull. Lately a number of these steel-hulled ships have been docked for repairs and the plates torn away. It was found in every instance that where a plate had received a cement coating it was as sound and bright as when first placed in position.

On the other hand, where a vessel had not been coated, the steel was pitted and corroded, and in some cases this honey-combing extended clear through the plate. The effect was further noticed on vessels which were only lined on the inside. The outside half of the steel was thoroughly "rotted," while the inside, protected by cement, was as bright and sound as when new.

HANDSOME CABIN LAUNCH

An extremely neat cabin launch has been placed on Lake Chautauqua. The forward cabin is occupied by the power plant and operator, with berth, and other conveniences and lockers for supplies. An awning with side curtains extends to the main cabin. The cockpit also has room for several chairs. The boat is 45 ft. long.



A Pleasing Idea in Motor Boat Construction

ENLARGING A TUNNEL IN SCOTLAND

While Trains Run on Time

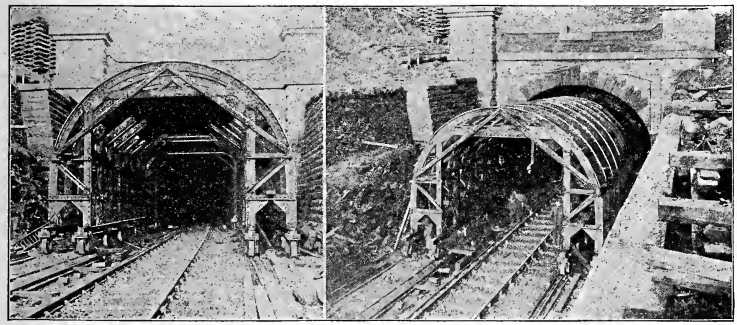
A tunnel on the Caledonian Railway, of Scotland, began to give trouble on account of the roof falling in. It was constructed 55 years ago and was driven through solid rock. Springs and the locomotive gases caused the stone to decay, greatly endangering the safety of trains.

It was decided to remedy this by lining the tunnel with brick and at the same time widen it from 24 ft. to 26 ft. 6 in. This was a difficult task to undertake without interfering with traffic, which was exceedingly heavy, some 200 trains passing each day.

First the double track system was removed and a single track run through the tunnel. Narrow gauge lines were laid on both sides of the main roadbed, and on these enormous shields were run in to act as protectors for the workmen. These shields conformed to the shape of the tunnel, as shown in the illustration, and were built of steel and wood. They served not only to protect the men, but supported the roof as well and kept the main line entirely free from obstruction, forming a tunnel within a tunnel.

The roof and sides were lined with brick, generally six courses deep, although in some places where the rock was greatly decayed it was necessary to fill in with solid masonry to a height 12 ft. above the original roof line.

As the workmen tore away the soft rock it was deposited along the track and not removed until Sunday, as traffic was less congested at that time. As the rock was being removed a supply of brickwork and masonry materials sufficient for the next week's work was brought in. Compressed air was supplied to the shields at all times and the tunnel lighted by 300 electric lamps. The total cost of the work was between $400,000 and $500,000.



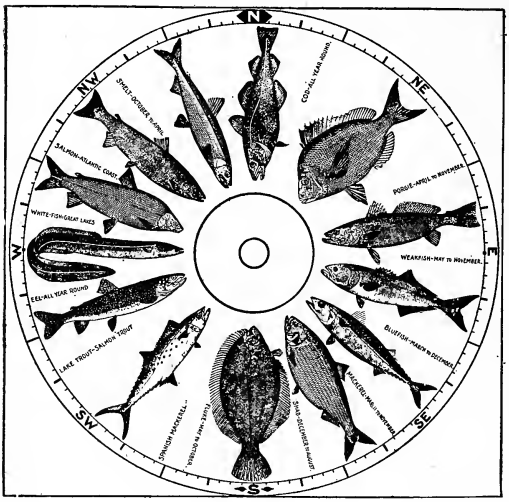
The Shields that Protected Workmen and Trains

LIFE TINTS FOR THE DEAD

The latest accomplishment in modern embalming is a preparation which when mixed with the embalming fluid imparts to the dead body what is said to be a life-like color. By using the proper quantity according to the age of the deceased the face is given the rosy hue of youth or the less pronounced color of adults. The preparation is non-poisonous, and renders the body firm without making it hard.

A new hotel which is being built in Paris for American guests will include the use of an automobile with each suite of rooms.

UNIQUE ADVERTISEMENT OF FISH DEALERS



An original and interesting idea has been made use of by wholesale fish dealers in New York.

With the compass points as a circular border the leading market fish are represented as swimming toward the center, in which is printed the name of the firm.

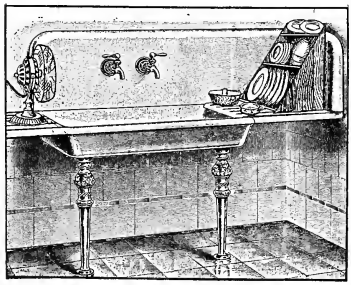
With the name of each fish is also given the months during which it is to be had.

When you purchase any of the fish named, in other months of the year, the chances are you are getting cold storage and not freshly caught fish.

ELECTRIC FAN IN THE KITCHEN

The utility of the electric fan is rapidly being extended from offices to residences and from the summer months to the entire year.

In the kitchen of residences the fan has proved even more welcome than in the office downtown of the owner. With a medium-sized fan, the position of which can be shifted by means of a few feet of flexible cord, even the hottest kitchen is made not only endurable, but actually comfortable! It is a time and labor saver also; kettles, pans, and other metal utensils, as well as knives, forks and dishes, can be dried without wiping by placing the articles in the path of the breeze. With dishes the best results are had by using racks or movable shelves, in which the dishes are placed to receive plenty of air. When one side is dried it is only the work of a moment to reverse them and expose the damp side.



Drying Dishes with Fan

Where quick action is needed in the home laundry, hang the articles on a line directly in front of a fan and they will be dried quicker than under ordinary conditions out of doors. In the sick room a fan is far better than ice for cooling purposes, as immediate results are had and no dampness is caused as with melting ice.

The electric fan is going to become as much of a household necessity as the electric light.

JAPANESE IMITATING AMERICAN PIANOS

The dreams which American piano and organ manufacturers have had of big sales in the far East, as Western ideas and luxuries increase, have had a set-back. The Japs are making musical instruments right at home, with machinery built in Japan, and which is a counterpart of the best machinery used here. They now recall with regret sundry Japanese workmen whose willingness to work led them to volunteer to do anything and everything around the factory, and whose skill made them prize employes.

These same willing workers, possessed of valuable secrets of manufacture, are now the superintendents of piano and organ factories in Japan.

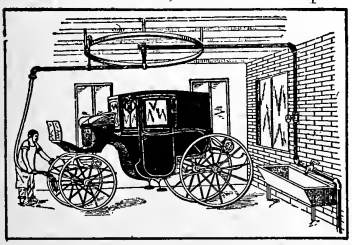
MELTED METAL RAN INTO THE SEA

Fire recently destroyed a cannery at Bellingham Bay, Wash., and $75,000 worth of pig tin, solder and other metals were melted and ran into the sea. It is hoped a portion of this metal can be recovered, but it will have to be shipped back to the smelters and go through a refining process before it can be used.

OVERHEAD WASHING MACHINE

An overhead washing machine is a great convenience in washing vehicles.

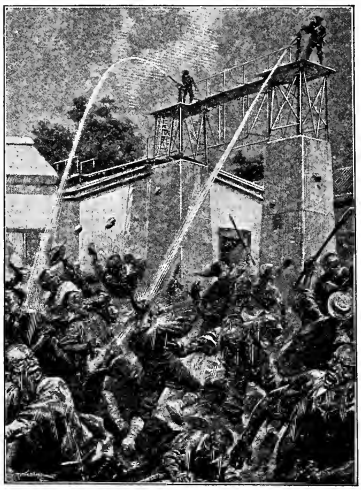
It consists of a galvanized steel track upon which a roller, mounted upon the end of a long arm, travels. The principal working parts are of brass, and the water-tight joints are specially constructed to not only wear well, but to prevent leaking.



Handy Machine for Washing

A COLD WATER GUN

American fire departments have occasionally rendered good service in dampening the ardor of a mob, but in the South African mines the scheme has been perfected and is constantly in readiness for use. The Illustrated London News says: "The water gun, a gigantic fire nozzle traveling on a high platform, commands the whole compound; and when a row begins among the coolies, this harmless but effective artillery is brought into play, always with excellent effect."



Shooting Coolies with Water

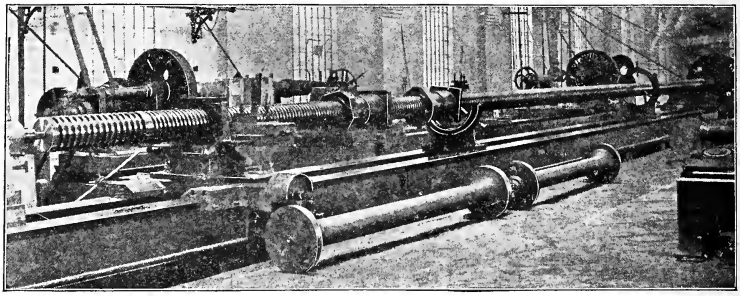
LARGE GAS HOLDER COLLAPSES

A large gas holder at Long Beach, Cal., collapsed and 700,000 cu. ft. of gas escaped. Nearby workmen were overcome and rescued with difficulty. The gas was carried on the wind for miles and the odor hung in the air for

hours after the accident. The collapse was due to the breaking of the reinforcing bands around the holder which had been weakened by the corrosive action of the moist, salt-laden sea winds.

SCREW 74 FEET LONG

A remarkable pair of screws for shear legs was turned out at works near Birmingham, Eng. Each screw



Enormous Lathe—Cutting Screw 74 Ft. Long

AUTOMOBILE ENGINE CLEANED WHILE COASTING

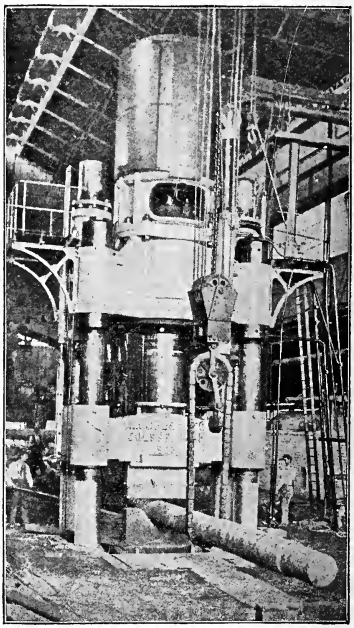
When coasting a hill of length, open the switch, open the throttle wide and leave in the clutch. This will draw full charges of carbureted air through the cylinders and expel the unburned gases from the muffler. This not only cools the engine, says Motor, but the spray of gasoline has a cleansing action on the valves and piston which loosens the burnt oil binding the deposits of carbon and dirt. Use care to always retard the spark fully and partially close the throttle before turning on the switch.

ALUMINUM TO PREVENT MERCURY POISONING

An Italian inventor has discovered a plan whereby the disastrous effects of mercury upon metallurgical workmen may be overcome. He has found that aluminum has a strong affinity for mercury and he proposes furnishing the laborers with light aluminum helmets, the breathing spaces being covered with a fine gauze made of aluminum wire.

The new ocean liner "President Lincoln" will be 616 ft. long, with accommodations for 3,750 passengers,

has a pitch of 2 in., diameter of 11½ in., with a total length of 74 ft. It



Hydraulic Forging Machine

has gun metal bearings and will be used in 100-ton shear legs. One of these screws is shown in the illustration. At these works forgings up to 30 tons are machined and finished. In forging, the German hydraulic press illustrated is used.

PLOWING IN A SHIP'S HOLD

A common, everyday farm plow was used in unloading the cargo of the "Ammon" at San Francisco. The entire hold was filled with 1,500 tons of nitre, which had frozen into one solid mass and very hard. Explosives could not be used, and picks and shovels were too slow. As a joke a bystander suggested they better use a plow.

The captain, however, decided to try the plan, and bought a good sized plow, and by means of block and tackle and steam winch pulled it back and forth the length of the hold. The plow loosened the nitre as fast as a big gang could shovel it into the steel buckets. This is probably the only instance on record where a ship's cargo was discharged in this way.

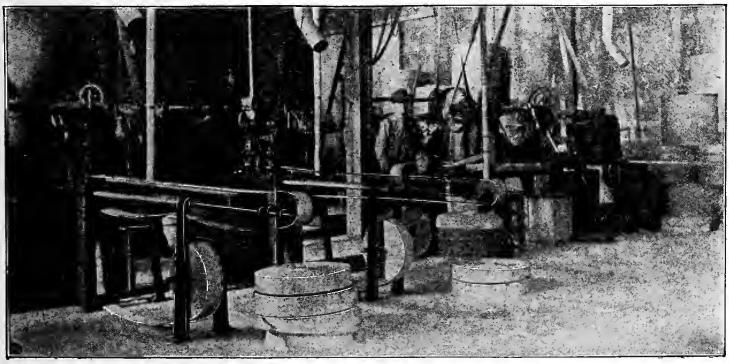
The lowest submarine so far is the "Octopus," which stayed down 39 minutes in 215 ft. of water off Boston Light. Although the pressure at that depth was enormous it did not leak.

MAKING 12,000 MATCHES A MINUTE

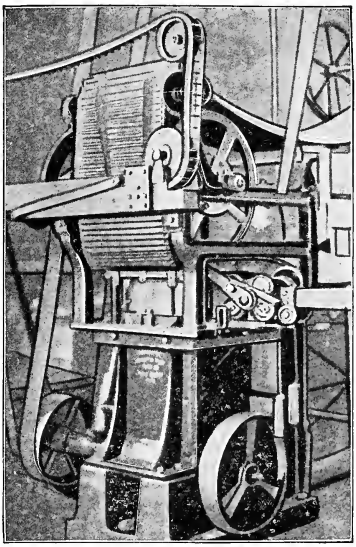
Twelve thousand a minute, or 7,200,000 in a day of 10 working hours is the record of the latest machine for making matches. The whole apparatus is 10 by 12 by 30 ft. in size, but it works with such rapidity that it has reduced the cost of production 50%. The machine is entirely automatic and from the time a match enters as a block of wood until it emerges, ready for packing, it is untouched by human hands.

Cork pine is used for the match timber and it is purchased in 2-in. planks. These are well seasoned, cut into match lengths, and fed into the machine by means of a block conveyer. The blocks pass under a battery of small knives. These knives are 48 in number and each one gouges down into the wood lengthwise with the grain and comes up bearing a match splint. Every knife cuts 250 splints a minute, and as each piece of wood is torn away the upper end is forced into a steel bar which has a number of perforations, each slightly smaller than the match.

The bar, which securely grips the splint, is a link that is part of an endless belt 500 ft. in length which takes fifty minutes to make a complete circuit. This belt carries the matches



Machines that Make the Boxes



The Match Machine

through a paraffin bath shortly after they come from the knives. The bath, or dip, makes them more inflammable. The paraffin is kept in a melted state by an ingenious contrivance which drains off the cooled liquid and adds more at a higher temperature.

The greater portion of the matches made now are of the noiseless type; that is, they have two tips. This tipping is accomplished by two rollers, the phosphorus friction material being put on by one and the chlorate of potash composition by the other. Both of these substances are kept melted in a reservoir and the rolls revolve in them at exactly the same rate of speed that the conveying belt travels, and as the match wood lightly touches the roll it is tipped with a small quantity of the igniting composition. Considerable time elapses between the dips, and the belt turns in various positions on its journey in order that each tip may dry to a regular shape. The extreme length of the belt is to allow the matches to become thoroughly dry before being packed.

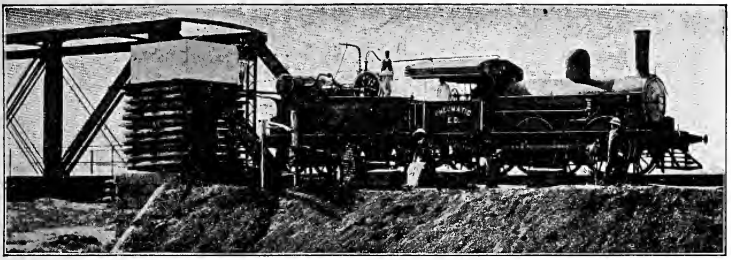
Just before the belt completes the circuit each completed match is pushed from its holding bar by pins which fit each perforation in the latter. As they fall on a shelf an endless chain conveys them to the packing table, where they are placed in boxes, wrapped and sent to the shipping room. Only five packing girls, and two helpers, are required to tend one machine, doing the work which in the older processes required twenty-five persons with a much smaller output.

In the old style of match-making a veneer was pared from a basswood log. This was cut into splints 17 in. long, the length of eight matches. A number of these were piled in a veneer cutter and an 8-bladed knife making 150 strokes per minute divided them into sections. The matches were paraffined in a big screen drum which dipped in a huge vat. After being dipped they were straightened by one machine, placed in dipping plates by another, and tipped by still another device.

The operation of making the boxes is one that is almost as interesting as making the match itself. The boxboard comes to the factory in large rolls and is there cut into sizes required for the various matches. It is then fed into the box machine and is stamped with the name of the company, cut to shape, and folded. The strip of sand paper on each side is made by passing a glue covered roller along the box and then throwing sand up against it.

Match-making by the new automatic machinery has already effected a saving to the consumer. Where formerly 100 matches were sold for a penny the consumer now pays only five-eighths of a cent for that number.

As was predicted a year ago, the craze for young employes is beginning to subside, and it is perceived that experience and reliability are better than mere youth. The age limit for entering the employ of the Pennsylvania railroad has been raised from 35 to 45 years.



Compressed Air Plant for Working Pneumatic Tools on Indian Locomotive

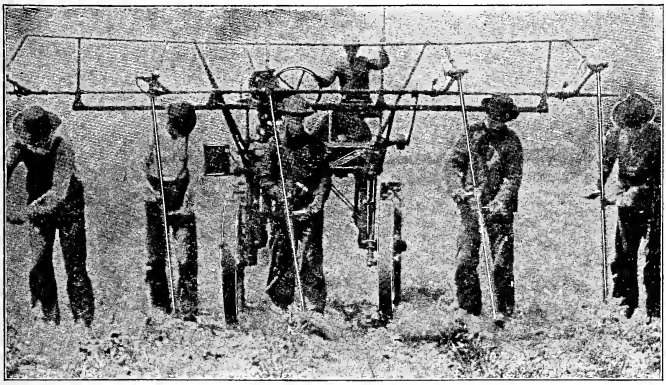
THE RAISING OF SUGAR BEETS

A Vast Industry Waiting for Labor-Saving Machinery

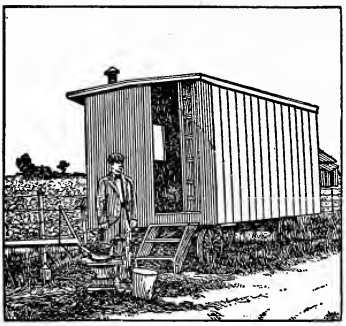
Sugar was made from beets one hundred years ago, but it cost as much to make one pound then as the grocer charges for 15 lb. now. While improved machinery has contributed its share to this reduction, an improved beet has done more, for 2,400 lb. of sugar is now obtained from one acre against 480 lb. in the early days.

When a beet sugar factory is built it means increased value for thousands of acres of land; in many cases an advance from $10 to $100 per acre. And this is permanent, for the department of agriculture has found out a way to raise beets indefinitely without destroying the land, as was once feared.

A sugar beet seed is really five to seven seeds in one—there's a fortune for a machine which will separate these germs without crushing—hence a vast amount of hand work becomes necessary to thin beets soon after they come up. Here's a chance for another machine. Then there are from two to five hoeings. This, too, has been hard work, although a new machine hoer is being tried. This queer device is mounted on high wheels, and is driven by a gasoline engine. Several steel



Mechanical Hoe for Working Sugar Beets



A Portable House

shafts hang from springs and universal joints which permit movement in every direction. The lower end of the shaft has a steel disc which revolves rapidly. The operators guide this circular toothless saw where it will do the most harm to the weeds. The machine needs improving.

The harvesting includes three operations, lifting, pulling and topping. A sort of plow loosens the beet but it must be pulled by hand and the tops cut off. Many forms of beet harvesters have been constructed, but none has come into general use. The cost of hand harvesting is from $5 to $8 per acre. A practical harvester will certainly be worked out before many years. When harvested the beets should be hauled at once to the factory, or to the railroad for shipment. At the factory a system of siloing is employed when the shipments come in faster than they can be worked up.

The effort is to have the beet raisers plant at different times to spread the harvest time out as long as possible. The farmer is glad to join in this because of the large amount of hand work involved at certain periods of the beet's growth. In some states there are colonies of experienced beet workers who live in houses on wheels and move from one beet farm to another.

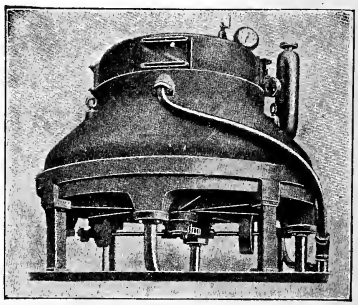
These houses will accommodate five people and cost $75. The outfit includes a laundry stove, cooking utensils, woven-wire folding cots, mattresses and blankets. When the work for one farmer is finished he furnishes the teams to draw the colony to the next place or to the depot, if the distance requires transportation by rail.

The industry of beet raising in this country is a large and growing one. Last year the crop produced 312,900 tons of sugar, valued at $28,162,800. The opportunities for the invention and improvement of labor-saving devices in this field are unusually inviting. The average cost of hand labor at present required on each acre of beets is $20. Suitable machinery if it could be had, would reduce this figure at least one-half. This would mean a saving on the year past of $10 per acre on 307,000 acres or $3,070,000. The current yearbook of the Department of Agriculture, from which these facts are taken, devotes considerable space to beet raising.

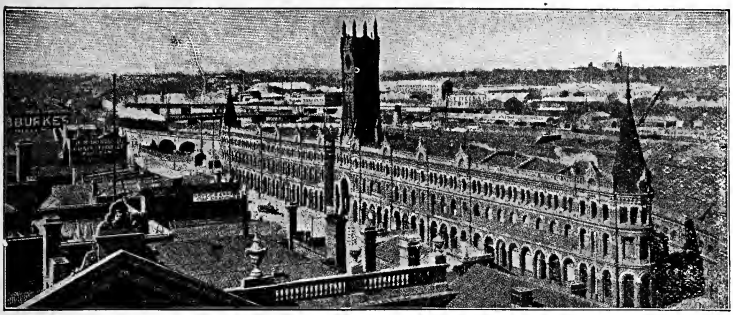
VACUUM PROCESS FOR CONCENTRATING ORE

The new vacuum process for concentration of ores is attracting considerable attention, especially as the machinery is so simple it can be built in almost any machine shop, and in operation no skilled labor is required.

Oil and acid are mixed with the flowing pulp of crushed ore and water as it comes from the crushing mill. The oil attaches itself to the minute portions of mineral, but has no effect



Vacuum Concentrator



The above picture shows a view in Melbourne, Australia. The large building is the government warehouse and cold storage quarters, where fish, meat and produce are prepared for shipment to London.

upon the rocky particles or gangue. The whole mixture is then subjected to a pressure less than the atmosphere.

When the vacuum is applied the air and other gases dissolved in the milling water are liberated. These gases attach themselves to the greased mineral particles and rise to the top, carrying the ore with them in the form of a rich concentrate, which overflows into a pipe leading to a reservoir.

The rocky particles or gangue remain at the bottom and are thoroughly agitated until every bubble of liberated gas has carried its bit of mineral to the surface. They are then discharged through a waste pipe.

The Mining World, London, says: "The quantity of oil and acid required is not the same for all ores, but usually amounts to not more than a few pounds —say, from 3 to 10 lb. per ton of ore treated."

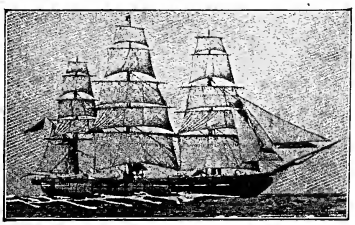
A large variety of oils and similar substances have been tried and found suitable, such for instance, as Californian crude oil, Texas crude oil, Texas residuum, fuel oil, Russian crude, Borneo, Sumatra, and similar cheap oils, tars, blast furnace oils, olive oil residues, oleic acid, kerosene, a variety of light oils and fish oils. The process is patented.

Burglars are using automobiles for making their "visits" and carrying off the plunder.

FARRAGUT'S FIRST VESSEL TO BE SCRAPPED

The old weather-scarred frigate "Saratoga" is to be destroyed. This was Admiral Farragut's first command, and since 1889 it has been the training ship for the Pennsylvania Nautical School, an institution maintained by the state for training the youth of Pennsylvania in the science and practice of navigation. During her cruises the "Saratoga" has visited all the prominent continental ports and places of interest in the world.

Four years ago it was necessary to completely overhaul her on account of the terrific storms that she had passed through. On the last cruise out six gales were encountered in thirteen days and it required every effort of the youthful crew to keep the old vessel afloat. When it was finally brought safe to shore, the naval authorities found that it would require too much money to put it back into shape again, so determined to sell it for old junk.

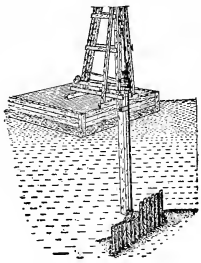


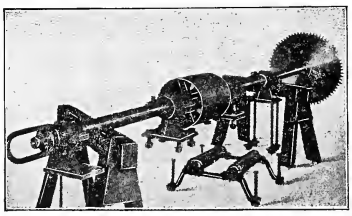
KILLED BY CHARGED FENCE WIRE

Death recently came to a ranchman of Bellegrade, Mont., in an unusual and peculiar form. A highly charged transmission wire, which crossed his ranch, became broken in some manner and one end fell across a barbed wire fence. The ranchman, not knowing of the break, attempted to crawl through the fence. His body completed a circuit to the ground and he was instantly electrocuted. His wife attempted to remove the body but was rendered senseless by the shock she received. Neighbors finally removed the corpse, but only after considerable danger to themselves.

CUTTING PILES UNDER WATER

The illustrations show a complete apparatus for sawing off piles as deep as 24 ft. below the surface. The first is a pile driver from which the hammer has been removed and the sawing mechanism has been substituted between the guides. At the end of the saw-shaft (Fig. 2) is seen a loop by which it can be raised or lowered. In the middle is a drum for belt, and just below it appear the rollers, which are to fasten to the guides to keep the belt in place. A spline through the whole length of the shaft makes the saw readily adjustable to any depth within its range and also takes up any vertical motion of the pile driver due to motion of the water. The shaft is $3\frac{7}{16}$ in. diameter and counterbalanced by the timber shown in Fig. 1. For most piles a 42-in. saw is sufficient, and 10 hp.; for extra large piles, a 48-in. saw and 12 hp.

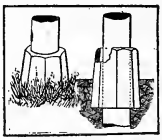




Shaft with Saw

CEMENT BLOCKS PRESERVE POLES

To prevent deterioration of wooden poles at the surface of the ground, where decay usually begins, a French inventor uses a pair of cement blocks. These blocks surround the pole and extend 1 ft. into the ground. When locked in position cement is poured between the blocks and pole.



MAKING JEWELRY AT HOME

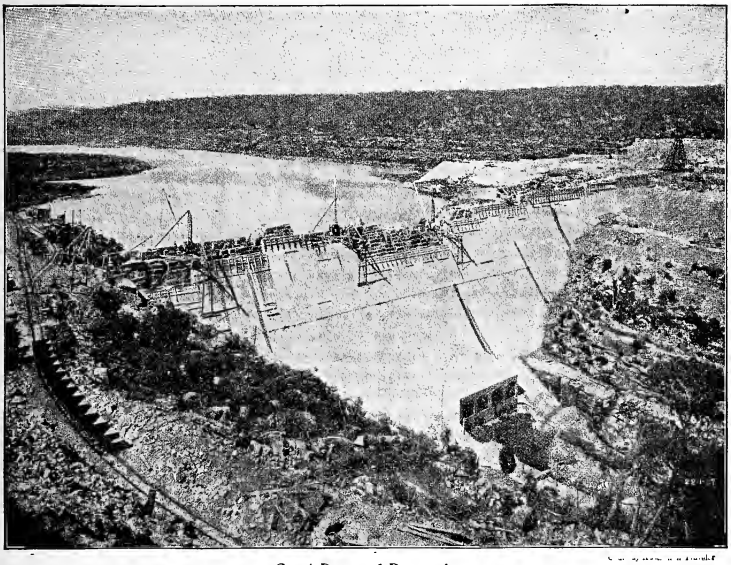
Thousands of women in Massachusetts and Rhode Island are earning a tidy sum each day without leaving their homes. The unprecedented demand for all grades of ornament has caused jewelry manufacturers to resort to every expedient to supply their orders. The practice of allowing the women to take home work, finish it and return it to the factory has grown up and is now one of the most extensive in the New England states.

Much of the work is simple and can be done by hand; for example, in the manufacture of the ring or chain purses which are so popular, a pair of pliers is the only tool used. The price for making one of these varies from 50 cents, for the small ones, to $1.25 for the larger size. A fast worker can often make two of the smaller in a day.

Some factories have installed foot power presses in the houses and larger articles are made. Work is delivered and collected weekly or oftener, by an agent of the company.

SYDNEY, N. S. W., STOPS A BIG RIVER

And Diverts Its Waters to City Use



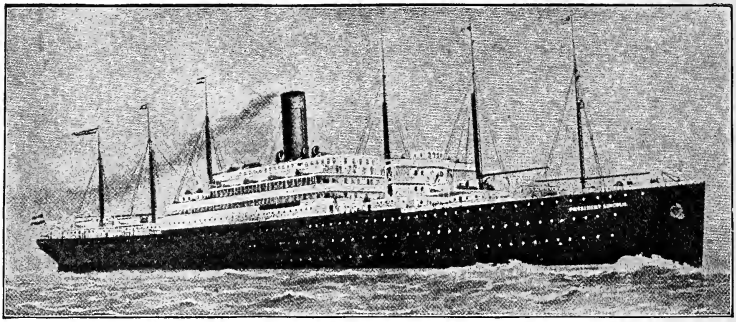
Great Dam and Reservoir

Sydney, New South Wales, is a great consumer of water, and at intervals during its century of growth has reached out first for small streams, then lakes and small rivers, and now the entire flow of the Cataract river. The river has been brought to an abrupt stop in its course by the construction of a great concrete dam 811 ft. long and 192 ft. high. The dam is 158 ft. wide at the base and 16½ ft. at the top and stores up the flood waters in a reservoir 150 ft. deep, covering 2,200 acres, and containing 21 billion gallons of water. The work, which was done by the government, occupied two years, cost $1,500,000 and was accomplished with machinery brought from the United States and England.

HORSESHOES MADE OF ASBESTOS

Visitors to the volcano of Kilauea, on the island of Hawaii, generally ride on horseback, and in crossing what is known as the "pit," the horses suffer much from the great heat. The earth is so hot that the hoofs of the horses are not infrequently scorched. As some protection became very necessary, a clever blacksmith in Honolulu has recently devised a very successful method by which asbestos may be used.

The idea is to provide the hoofs of the horses with an asbestos covering much after the fashion of the outer shield of iron-studded leather or canvas over the automobile tires. These hoof shields may be put on and removed at pleasure.



The New Hamburg Liner "President Lincoln"

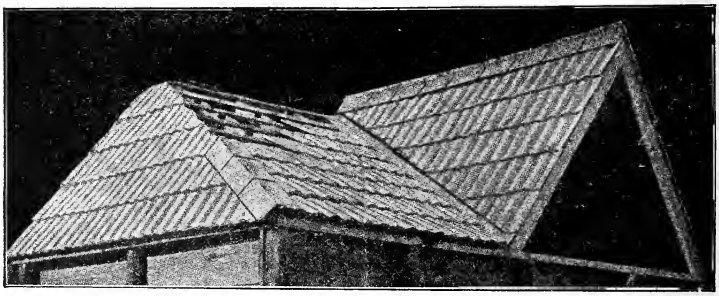
RAILROAD CROSSES A MUD DESERT

Railroads are sometimes built under very peculiar conditions. This is the case with the Western Pacific Transcontinental line that is being constructed from Salt Lake City to San Francisco. The line runs 38 miles through a stretch of the Utah desert, where nothing but soft alkali mud is to be found. This "mud desert" seems to have no bottom and it was exceedingly difficult to secure a satisfactory footing for the roadbed.

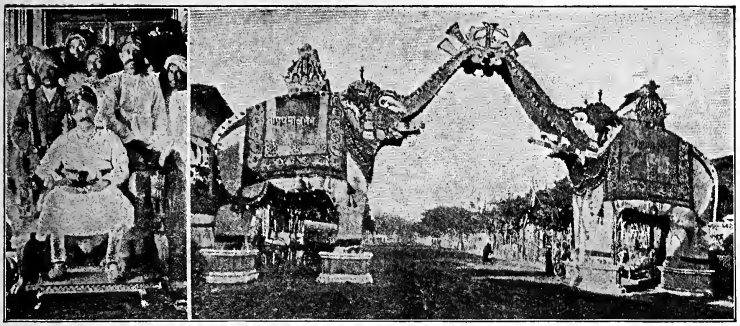
The trouble was solved by a foundation made of heavy planking laid checker-board fashion. Temporary tracks were laid on this and ballast trains distributed their load upon the wooden base. The rails were raised, as the depth of the ballast increased, until the proper grade was reached. The roadbed was then covered with cement and gravel, which formed a hard level surface for the tracks. The filling and mud of the desert practically excludes the air from the planking and insures it against decay for a long period of years.

COLONIAL WALL PAPER REVIVED

The wall papers brought from Naples a full century ago still remain with colors so fresh they promise to endure another hundred years, in many New England homes. So attractive are these quaint designs that wall paper makers are now busy copying them for 20th century residences. The designs are largely landscape scenes.



Tinted Shingles Are Now Made of Cement



Triumphal arch of great magnificence erected for the installation ceremonies of Prince Ranjitsinhji the Jam of Newanager. The elephants were covered with costly tapestries, ornamented with gold and illuminated at night with hundreds of electric lights. The Jam rode through the arch in a silver carriage, wearing a red robe prepared for the occasion and destroyed immediately afterwards. The throne and canopy are of solid gold. During the ritual the Jam is required to hold a cocoanut in his hand.

LARGEST GASOLINE PASSENGER LAUNCH IN THE WORLD

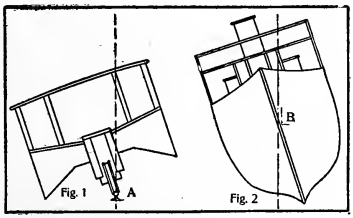
What is believed to be the largest gasoline passenger launch in the world, says the Journal of Electricity, has been in regular service since January 1st, plying between San Pedro harbor and San Diego, Cal. The vessel is 140 ft. long, 22 ft. beam, with a draft of 10 ft. It carries 256 gross tons of cargo, and 260 passengers at an average speed of 14 knots per hour. The equipment consists of two 300-hp. 6-cylinder engines, which drive twin screws. It is said that the engines have never stopped for repairs since their first alignment.

GYROSCOPE WILL NOT EFFECT SHIP'S STABILITY

A train of cars, such as Mr. Brennan's monorail type, have the wheels fixed so they cannot move to the right or left. As a result the center of gravity of the car will swing in an arc about the point of support. An ideal condition for a gyroscope is the result, in fact, this is one of the principles of that mysterious apparatus.

The centrifugal force of the spinning wheel in a gyroscope applies its balancing force to the axle points, whether it be a pin point or set in a bearing attached solid to some other point. So, in the case of the single rail car, the double flange wheel at the point where it touches the rail takes the same place as the point that touches the floor in the toy top.

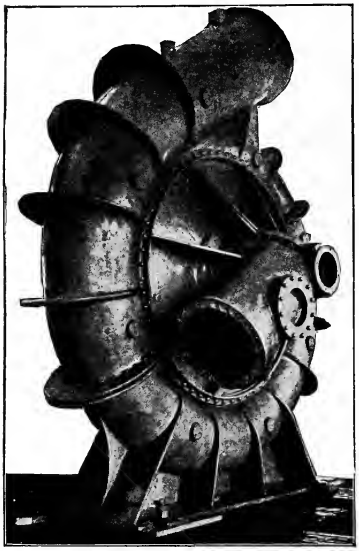
When the car is in a side wind, as shown in Fig. 1, the single rail, A, makes a solid point for the gyroscope to apply its balancing force. When a vessel is tossed about, or a side wind strikes it, the gyroscope's balancing effect is lost, as the keel of the vessel



has no fixed bearing and moves as well as the top, as is shown in Fig. 2.—Contributed by W. A. Waller, Lees Summit, Mo.

FIFTY MILLION GALLON CENTRIFUGAL PUMP

Two big centrifugal pumps have been built recently to irrigate rice fields in Southwest Texas. Each has a daily



Daily Capacity, 50,500,000 Gal.

capacity of 50,500,000 gal., or 35,000 gal. per minute. The impellers are so heavy no fly-wheel is required.

The water is drawn into the pump at the horizontal shaft and discharged through 36-in. nozzles. Note, in the accompanying illustration, the peculiar ribbed construction of the pump casings which gives great rigidity and strength.

A few years ago all the passenger cars on the New South Wales railroads had bars across the windows to prevent the passengers from putting their heads out. The passengers rebelled at the risk of being caged in a wreck, and the bars have been removed.

There are 10,460 saw mills in the United States. Pennsylvania has the largest number—714.

A MYSTERIOUS ISLAND

Denver Island is, at this writing, one of the San Juan group in Puget Sound, and was an extremely beautiful piece of land. A hustling real estate man sold it to Charles L. Tutt, a wealthy Colorado miner, who intended to erect a summer home in the midst of a beautiful park. When Tutt went to examine his purchase it wasn't there. He insisted he had been swindled, but witnesses were produced who swore it was formerly at the location stated. Tutt wanted his island—where was it?

Investigation proved it had completely sunk beneath the water during the San Francisco earthquake, leaving several acres of water but no land.

Recently the owner received notice that his island had come up again and he lost no time in getting there. The trees and foliage were all dead and slime covered the surface once green with grass, but Tutt had recovered his property and promptly christened it Denver Island.

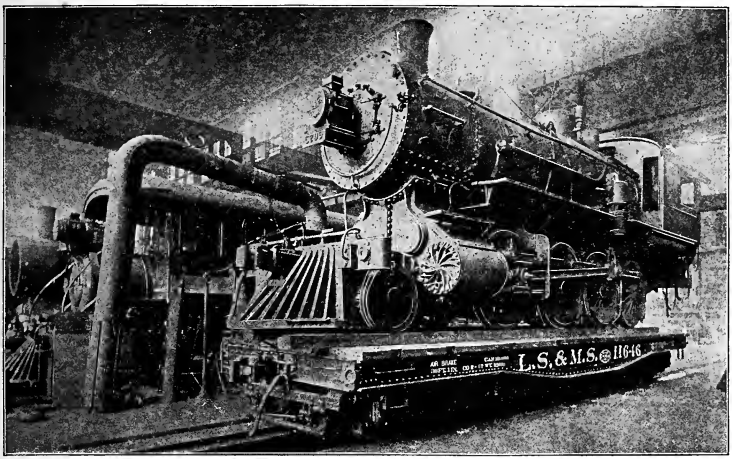
FISH SOAP HARMS NICKLE-PLATE

Fish soap as a cleansing medium is gradually being replaced by other more satisfactory materials, says the Brass World. A number of cases are known where the use of it has been the direct cause of nickel deposits peeling away.

In one instance it was found that the deposit came off notwithstanding all efforts to make it stick. The piece which was to be plated was first buffed and then soaked in a fish soap solution to remove the dirt collected in the corners. After soaking, it went direct to the plating bath without additional cleansing. As a result an extremely minute film of fish oil entirely covered the work and prevented the nickel from closely adhering to it. After the trouble was discovered and this film removed by placing the article in another bath, the peeling of the deposit entirely stopped.

75-TON STEEL FLAT CAR

Unusual Test to Which Steel Cars Are Put to Determine Their Safe Maximum Load



"As a Test an 80-Ton Locomotive Was Run on the Car"

Five 75-ton steel flat cars have been built at the Collinwood shop of the Lake Shore road. These cars are 36 ft. 6 in. over all and 9 ft. 8 in. wide. It is designed to stand an overload of 10 per cent., and as a test an 80-ton locomotive was run on the car, as seen in our illustration.

FAST OCEAN RACING

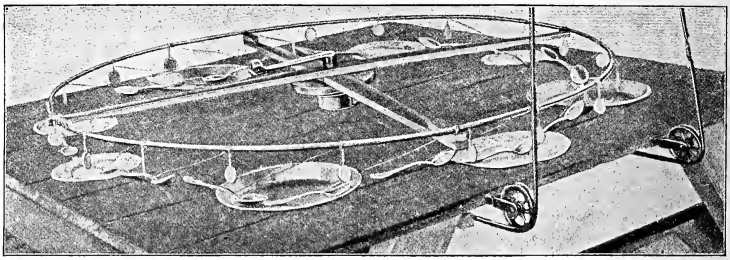
Now the record time across the Atlantic from Daunt's Rock to Sandy Hook lightship is reduced to 5 days 18 hours and 39 minutes. That was the outcome of a spectacular race between the English "Lucania" and the French "Lorraine," in which the former not only overtook but passed the latter. A lot of money changed hands on the race and it was great fun for the passengers.

ESCAPE FROM A VAULT

A knowledge of telegraphy enabled Geo. Stewart, who was accidentally locked in a safety vault at Pueblo, Col., to escape. The office had a private wire which passed through the vault. By cutting the wire and using the two ends as a key he quickly had the sounder out in the office repeating the word "help" and then slowly spelled out his trouble, which secured his release.

TESTING THE LIFE OF SPOONS

When a reputable manufacturer of plated tableware guarantees a set of spoons or forks to last a certain number of years the purchaser accepts the statement in good faith, but wonders how the maker knows. The life of a plated spoon, however, is not a matter of guesswork, but is based on actual experience. To wait 20 years to determine whether the ware will endure that long would obviously be impracticable. To get quick action "natural-wear machines" are used. Tin and china plates of various sizes are fastened in a circle to a table; over the pates a metal ring revolves, to which the article to be tested is fastened. An electric motor keeps the ring in motion, and at each revolution the spoon or fork is dragged across ten or a dozen plates. As the ring makes 500 revolutions an hour each article is dragged across 5,000 plates, or 120,000 in 24 hours, for the machine can be left running all night. Hence one or two days in the wearing machine would represent as many contacts as a spoon would receive in the course of ordinary household use in a great many years, and the contacts are much harder and longer.



"To get quick action natural wear machines are used"

The congestion of traffic is much relieved by the use of the policeman's whistle at street crossings. One whistle means east and west traffic stop, north and south go ahead; two whistles mean the opposite.

STAMP-SELLING MACHINES

For about two years the advisability of setting up slot machines for selling stamps has been under consideration by the postoffice department. At last it has been decided to test the scheme in different parts of the country. The machines will carry postals and stamps for 1 and 5 cents.

HUMAN BAGATELLE BOARD

The human bagatelle board is a fascinating sport at summer resorts. The players seat themselves in wicker bas-

A New Sport

kets and slide down a steep incline, their direction being made uncertain on account of striking the iron posts. Prizes are awarded the players who make the largest score.

FROSTED BULBS POOR LIGHTERS

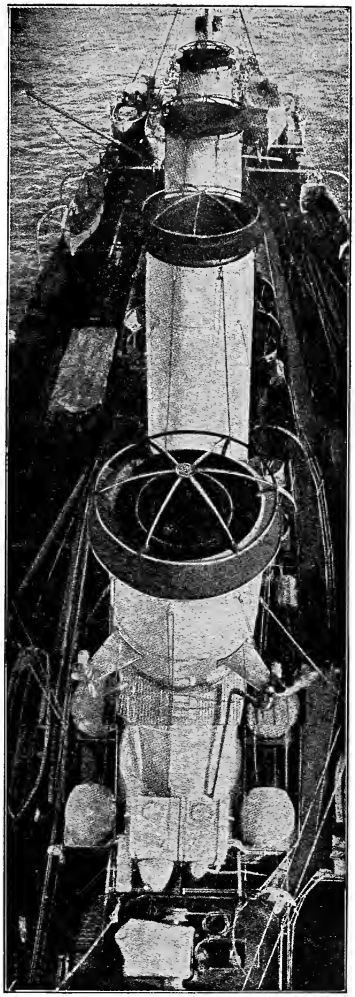
So long as carbon filaments are used there will be a fine deposit of carbon inside the bulb, and this, together with whatever dust may collect on the outside, increases the tendency of the rays of light to be reflected inside the bulb and absorbed by the frosted glass. With the new metallic filaments it is claimed that all internal deposit is avoided. The tungsten filament, for instance, is subjected to so high a temperature in the process of manufacture that all its impurities are said to be driven off.

NITRATES FROM ATMOSPHERE FINANCIAL SUCCESS

Getting nitrates out of the air by electricity has proved a big success. The plant at Notodden, Norway, at first designed to produce 5,000 tons a year, is being enlarged to increase the output tenfold. The enlarged works will use 50,000 h. p. from waterfalls, and the company is buying large additional water rights. Seems like picking money out of the air with Chilian nitrates fetching $55 a ton.

TELEPHONE NUMBER ON COW

A man living in a Chicago suburb who was troubled with his cow straying away conceived a novel idea of finding her. He painted his telephone number plainly on the cow, and when the animal wanders too far away some one who finds a strange cow on his premises calls up the owner, who sends for her.



This unusual photograph shows a cruiser, looking aft, the picture being taken from above.—Courtesy The Sketch, London.

It is stated no deposits of coal have ever been found in northern Africa. A French explorer has been trying to discover some south of Algeria, but without success.

NEW UNITED STATES WAR BALLOON

Official Recognition of the Balloon as a Factor to be Considered in Warfare

The army signal corps at Washington has a new war balloon, one of the largest ever made. It is simply a big gas bag and basket, without propellers or steering gear, and is capable of lifting four people. This is the first really large balloon in use by the U. S. army. Its first trip was recently made, going from Washington to Linglestown, Pa., a distance of 149 miles, in 4 hours 37 minutes.

Opinions differ as to the practical value of balloons and airships. Rear Admiral Sigsbee says:

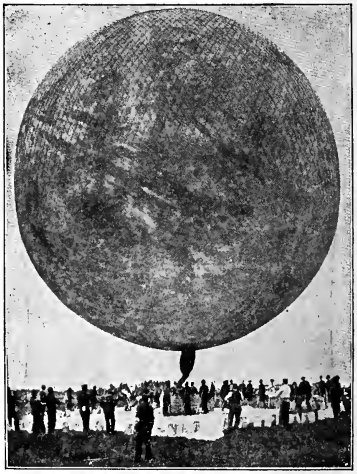
"The airship may in time prove a dangerous enemy by dropping explosives into a city, but as a force against naval fighters it will never do."

Rear Admiral Chester says:

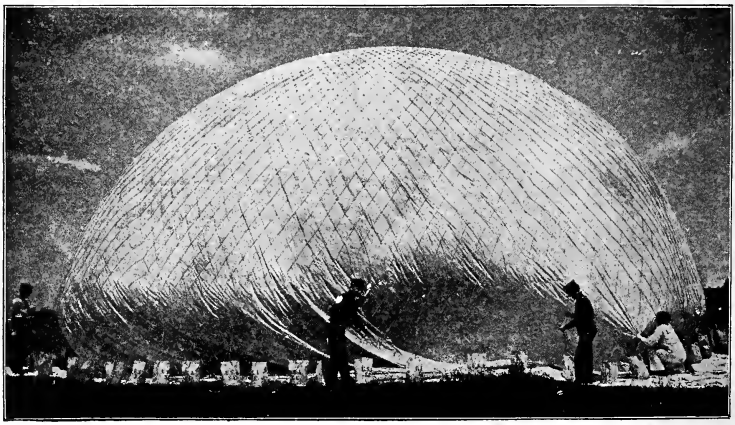
"We old fellows have seen the sailing vessel give way to the armor-clad steam warships, and I predict that the future will see the aeroplane fighting machine.

"The aeroplane will be used for scouting purposes. With the aeroplane the enemy can be seen 100 miles away, which is now impossible, and with it the submarines can be attacked.

"From the aeroplane, high above water, the submarine can be located beneath the waves and explosives dropped upon it, which is the only effective way of fighting it. The aeroplane is the fighting machine of the future."



U. S. War Balloon Copyright W. Fawcett



U. S. War Balloon Partly Inflated Copyright W. Fawcett

PARIS DOG POLICE

Trained Newfoundlands Rescue Suicides and Are a Terror to Criminals

Dogs have long been used for smuggling on the Franco-Spanish frontier; as life-savers on the high passes of Switzerland; and also on the field of battle to seek out the wounded. But it is only of recent years that they have come into vogue as municipal aids. The idea is due largely to the Burgomaster of Ghent, who inaugurated the idea, and now has nearly 50 canine police at quays; and, moreover, "apaches" or dangerous hooligans lurked beneath the bridges and sallied forth at night, a terror to the belated pedestrian. These thugs occasionally stunned their victims and cast them into the river, where they were drowned before aid could reach them. Thus the Paris dog police are both life-savers and deterrent agents.

Trained Dog Police of Paris

work, greatly to the benefit of the city. For crimes—especially night crimes—have decreased quite 50% while the expenses have been extremely small.

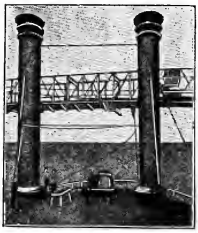
It stands to reason a dog is cheaper to maintain than a human officer; yet if well-trained he is more feared by the criminal; swifter in chase, and impossible of evasion, no matter how artfully a man may hide. So successful has the Ghent experiment proved that the movement spread into France, Germany, Italy and Austria. There are now bands of powerful Newfoundlands employed with the River Police of Paris.

M. Lépine, the Prefect of Police of that city, found it very difficult to insure the efficient patroling of the river's

During the day they look out for suicides, and persons who have fallen into the river by accident; and at night they patrol the quays with their two-legged colleague, to whom they are directly responsible.

The headquarters of these dogs is on the Quai de la Tourelle, and here they are trained in rescuing human life from the river by means of dummy figures. It is a very amusing sight on practice day when the big dummy is thrown into the water with a great splash and one of the dogs plunges in, dexterously seizes the comical figure by the coat at the shoulder, and begins to swim for the bank with swift and powerful strokes. One of the dogs, named Athos, has already saved 14 lives in the Seine.

A CURIOUS DELUSION



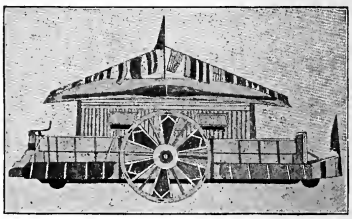
A normal eye never makes mistakes, but the mind often draws false inferences from the data which the eye supplies. An amusing instance of this is illustrated by the accompanying cut, showing the steamer Island Queen approaching the suspension bridge at Cincinnati and only 100 ft. distant. It looks as if the steamer's smokestacks would hit the bridge, does it not? That is just what several thousands of passengers have thought, with more or less alarm. The fact is that there is a margin of several feet.

STREET CARS AS DWELLINGS

Just before the big earthquake the street car company in San Francisco had put in service several hundred new cars, and consequently had an equal number of discarded cars on hand. The necessity for any kind of shelter created an immediate demand for the old cars, which were converted into houses. The cars were set up close together and made a row three blocks long. Small sheds or kitchens were added to each, water piped in and a small cook stove installed, with a stovepipe through the roof for a chimney. These emergency houses earned fabulous rents, and are still occupied. The illustration shows a nearby view.

AN AMPHIBIOUS AUTO

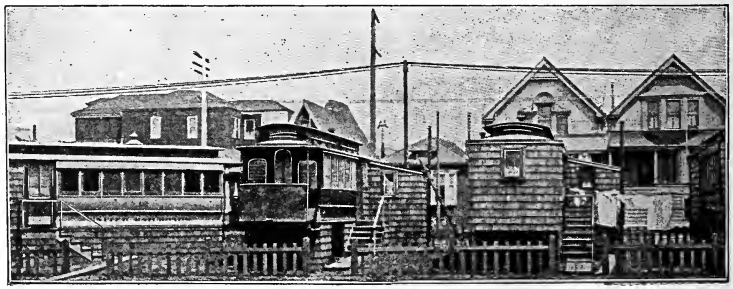
Of course it was bound to come—an automobile which can be run right into the water and become at once an autoboat. It was tested recently on the Seine, France, making a speed of 55 miles an hour on land and 15 miles in



Motor Car-Boat

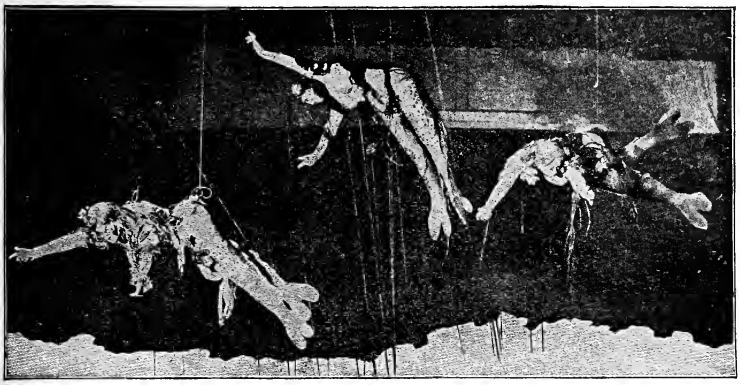
water. The front wheels are solid, so that they may be used for steering on either land or water.

Nikola Tesla claims that the Dreadnought could be destroyed by a tidal wave produced by the explosion of an 8-ft. cubical tank of dynamite below the surface even at a distance of $1\frac{1}{4}$ miles.

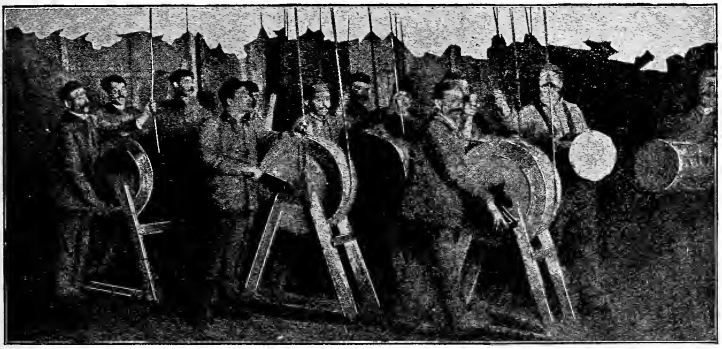


Several Thousand People Live in These Street-Car Houses

FLYING ON THE STAGE



The mystery of living figures on the stage which float motionless in mid-air or fly gracefully about have ceased to be a secret; everybody knows the performers are suspended by means of fine wires of unusual strength. The public never sees the machinery for raising and lowering the wires, and the above illustration, which shows how this is done, will be interesting. The drums on which the wires are wound are turned by hand, and require considerable practice in their operation. The operators all face a leader, who gives the orders quite like the leader of an orchestra.



BARREL POSTOFFICE IN MID-OCEAN

About 600 miles west of Ecuador, on the Equator, lie the Galapagos or Tortoise Islands. A barrel anchored securely off the shore serves as an international postoffice. It has neither postmaster, regular mails, stamps, nor appropriation—just an old barrel, placed there by the British government for the reception of mail by passing ships.

And yet two letters have recently been received at Washington, D. C., from the barrel postoffice of the Pacific and will be duly forwarded to the persons addressed. Having been written in October, 1905, and being rather the worse for weather and insects, these letters will probably have more interest as curiosities than as news.

ELECTRIC MECHANICAL BOOK-KEEPER

One of the leading Chicago banks, which employs 600 clerks, expects to be able to greatly reduce its force by the use of a new mechanical calculator. This machine does much more than the adding machines already in general

The Mechanical Book-Keeper

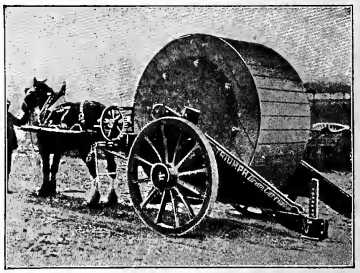
use. It adds, subtracts, divides and multiplies and calculates in both vertical and horizontal lines simultaneously. It is operated by keys and resembles a typewriter. It is run by a small electric motor and prints its records. It is the invention of a bank bookkeeper, who has spent 12 years in perfecting it. He claims it will save one-half the time now spent in keeping books.

AN ELECTRIC BATH

The usual methods of applying electricity for remedial purposes are unsatisfactoy in several respects. If electrodes are applied to different parts of the body much of the current passes over the surface and a strong current is too intense at the points of application. If it is sought to avoid these objections by placing the patient in a bath tub most of the current will go directly through the water, besides all the trouble and exposure of the bath. To obviate these and other difficulties four small baths have been devised, one for each limb, as seen in the cut. They are filled with water to cover $\frac{1}{3}$ of the upper arm and $\frac{2}{3}$ of the leg, and each tub has an electrode. In this way the action of the current may be made either local or general, and may be so directed as to affect certain organs especially. There is no need of undressing or of lying down, the latter being particularly important in cases of weak heart.

ENGLISH CABLE TRUCK

The illustration shows the latest heavy truck construction for handling big drums of telephone or telegraph cable, with one man and one horse. A load can be taken on or discharged in four minutes. On each of the inclines is seen a groove. In these grooves slide two iron supports on which the ends of

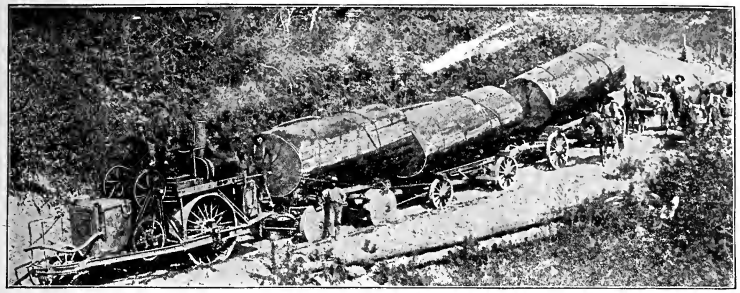


Loads 4 Tons in 4 Minutes

the drum axle rest, and each support is attached to a worm gear (seen in front of the drum) by a light cable. By this gear one man has no difficulty in drawing up a 4-ton drum.

The sum of $3,000,000 has been appropriated by New York City for a memorial bridge across the Spuyten Duyvil, to commemorate the tercentenary of the discovery of the Hudson River.

TRACTION ENGINES IN LUMBER TRADE



Bringing Big Logs to the Mill

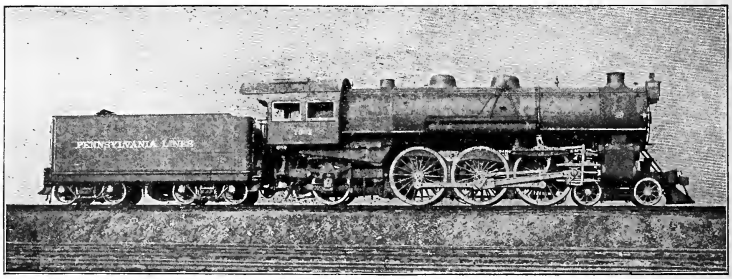
Like small streams running to a great river the traction engine lines of the California logging districts feed the railroads. Next to the Puget Sound country the mountains of the coast range and the Sierra Nevadas in northern California furnish the most extensive logging industries west of the Missouri river. These vast forests contain redwood, yellow and sugar pine, cedar, fir and tamarack. The lumber is shipped east and exported to Mexico, Panama, the Central and South American ports, Sandwich Islands, China, Japan, Australia, and even Europe.

In the movement of logs to the mill and lumber to the railroad, traction engines have replaced horses, mules and oxen almost entirely. A few teams are used to get the logs out to the wagon road, but much of this work is now done with donkey engines and wire ropes. It is no longer necessary to locate the mill on the railroad, for it can be erected in the woods and the lumber hauled on traction trains over any wagon road where teams can draw a load. It is much cheaper and quicker to build a good wagon road and equip with traction engines and wide-tired log wagons than to build the logging railway formerly employed, and when the district is cut over there is no track to take up and move. The size of the loads which can be drawn and the grades climbed is surprising.

Hauling Lumber from Mill to Railroad

HEAVIEST PASSENGER LOCOMOTIVE

What is said to be the heaviest passenger locomotive yet turned out has been built by the American Locomotive Company for the Pennsylvania road. It has 80-in. driving wheels and cylinders 24 by 26 in. Heating surface, 4,427 sq. ft.; boiler pressure, 205 lbs. Weight, on trucks, 45,000 lbs.; on drivers, 177,700 lbs., and on the trailer, 45,300 lbs.; total (without tender), 268,200 lbs.



Heaviest Passenger Locomotive

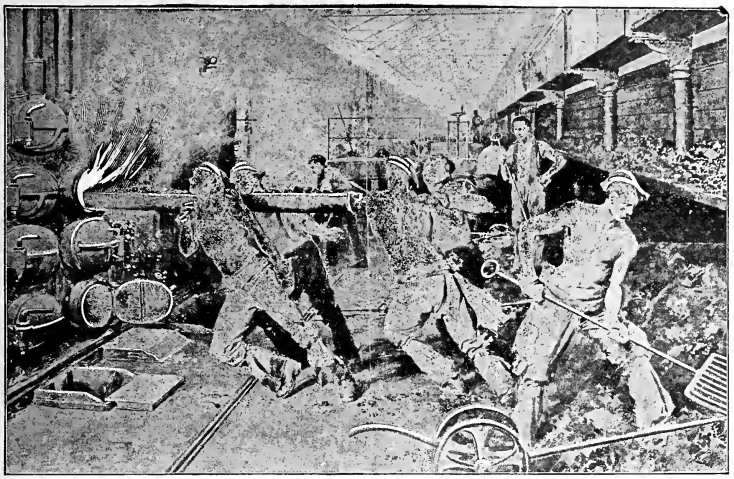
SONG BY PHONE GETS POSITION

A young woman at Reading, Pa., has started a new way of securing an operatic engagement, by singing a sample number into a long-distance telephone to a manager in Philadelphia. She got the job. The scheme opens up a variety of possibilities. In case an aspirant for the stage is long on voice but short on looks or shape the idea of inducing the manager to listen to her singing through the telephone is decidedly clever, for both distance and mystery lend their enchantment. On the other hand, may not this young woman's success in getting an engagement "on the wire" cause such a rush of singers to the telephone booths that managers will absolutely refuse to listen to any telephonic tones, however sweet?

BIG COLORADO DAM

The plans are drawn and the capital secured for a dam to hold back the waters of five rivers—a grand total of 5,000,000,000 cu. ft. of water. It will be 1¼ miles long, 150 ft. high and will cost $4,000,000. All of which is to happen 9 miles northwest of Denver, Col.

The Thomas P. Cole, 605 ft. 5 in. in length, longest vessel ever built for fresh water, on her trial trip. She is equipped with submarine telephone system and an electric whistle, which is sounded by means of a Morse key. An automatic arrangement sounds a blast every 10 seconds when in fog.



STOKING THE RETORTS—The above animated illustration from the London Sketch shows the men stoking the retorts in one of the big gas plants. A long sort of scoop is filled with coal, pushed into the retort, and is then turned round so that the coal falls out. The scoop is also used to push back the material that has already been placed in the retort. This is such an exhausting task that, though the stokers have 8-hour shifts, they actually work under 5½ hours, as they have to rest 20 minutes out of every hour. They have their compensations, however, for along with the other employes, many of them ex-soldiers, they hold stock to the value of $1,675,000 in the company, which turns out yearly 13,000,000,000 ft. of gas, for which 1,200,000 tons of coal are required.

WHALE LEATHER FOR GLOVES

The industrial use of the whale involves a wicked waste of material. For instance, from a right whale 50 ft. long may be obtained 250 bbls. of oil and perhaps 1¾ tons of whalebone. The remainder of the vast carcass, some 50 tons, is thrown away as absolutely worthless. There seems to be a gold mine here for any one with the enterprise and capital to work it. The hide of one whale, spread out, would cover 1,500 sq. ft., and when tanned makes excellent gloves and leather.

A TUNNEL ON PILES

A very unusual piece of engineering work is now being done in connection with the Brooklyn tunnel under East river. The tunnel rests on soft mud and quicksand in many places, and it was feared the additional weight of the trains might cause it to sag and break. To prevent such a disaster holes 20 in. in diameter are being cut through the bottom of the big steel tube and hollow steel piles in 5-ft. sections are put down into the mud. As fast as one section is down it is filled with cement and another 5-ft. section bolted to it and treated in the same way. This is continued until the built-up pile is 50 ft. long. Instead of driving, the pile is sunk by washing out a hole for it with a strong jet of water, into which the pile sinks of its own weight.

CONCRETE HOUSE COSTS MORE THAN WOOD

The comparative cost of a dwelling in New York state containing 10 living rooms and 2 bath rooms, according to materials used, has been found to be as follows: For wood construction a contractor bid $6,000; for concrete with wooden floors, $8,900; for hollow-tile blocks in walls and partitions and some concrete, $6,500.

Chief of Detroit Fire Department

A SUBSTITUTE FOR GASOLINE

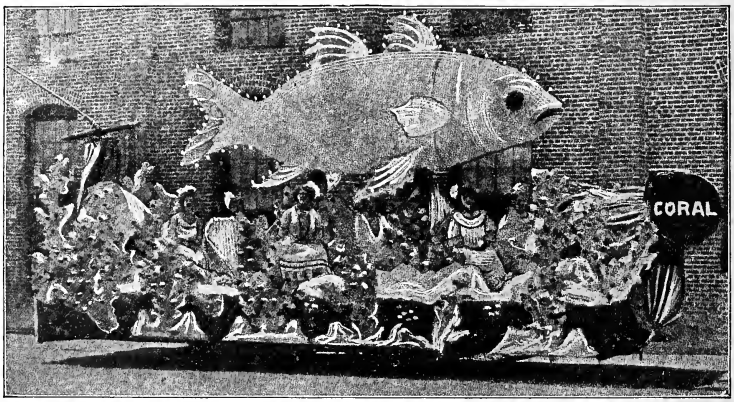
The enormous and increasing consumption of gasoline, besides the fact that it is practically under the control of the strongest trust in the world, makes any feasible substitute welcome. An English firm will soon place benzol upon the market as such a substitute, put up in cans of convenient size for use on motor cars. Benzol is very like gasoline in appearance and qualities, and can be sold at about the same price, with the great advantage that it is not in the grasp of the oil trust. It is a rectified spirit from the distillation of coal tar, which is a by-product of the manufacture of coal gas.

Experiments are still being made to perfect it as a motor fuel. It is claimed that benzol has some advantage over gasoline in potential energy, as tested by actual use in motor-car engines. Of course objections have been made to it, of which one is that benzol vapor is extremely poisonous. In odor it can claim no superiority over gasoline, the bouquet from the exhaust being just as sweet.

CONCRETE BRIDGE—NOT REINFORCED

While nearly all concrete work is reinforced in some way, it is noteworthy that a bridge is to be built in Baltimore of concrete pure and simple. And yet it is to be 322 ft. long, with one span of 142 ft. and three of 60 ft. each. The concrete will be made of one part cement to three of sand and six of broken stone. It is to cost $175,000.

Clean gold or silver watch chains by immersing for 5 seconds in pure ammonia, rinse in alcohol and shake dry in clean sawdust.

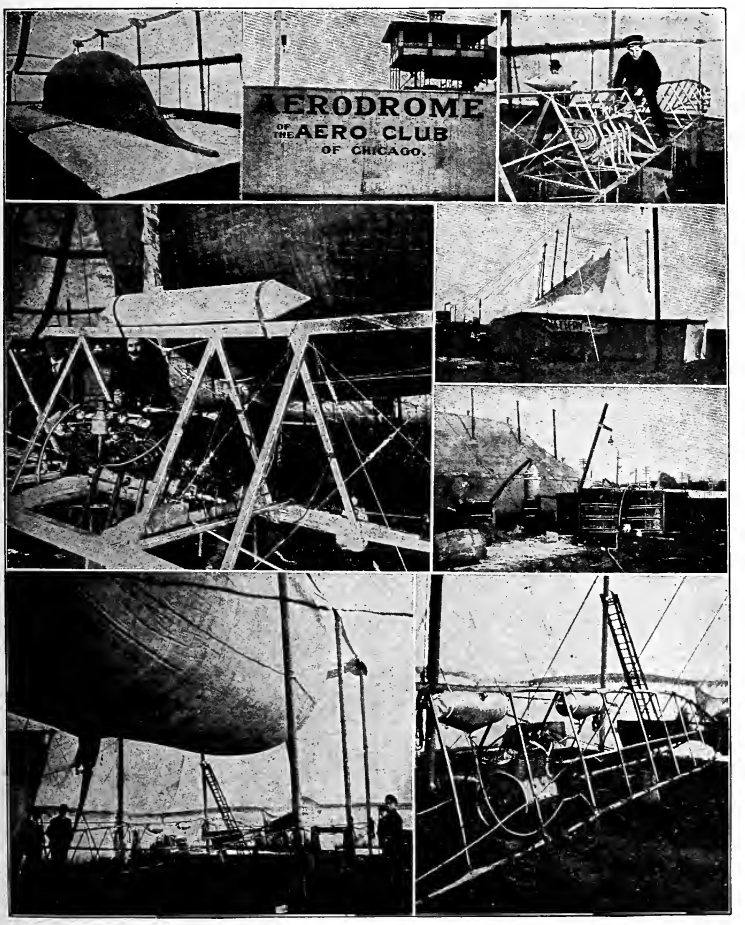


One of the floats in the annual parade at Los Angeles was named the "Coral" and represented a submarine scene. It was mounted on a street car truck, took its power from the trolley line, and was brilliant with sea-green electric lights.

AIRSHIPS IN CHICAGO

The Aero Club Gives Its First Exhibition

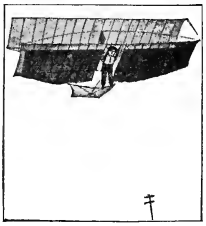
The opening of the Chicago Aero Club attracted considerable attention, the exhibit including three airships and one aeroplane. Capt. Mattery had a large ship with an 8-cylinder engine of 30 h. p.; Horace Wild and Chas. K. Hamilton each had an airship. A few flights were made but the entire week was rainy with high winds, which made long flights impossible and ascen-



Scenes at the Chicago Aero Club

sion dangerous. The gas bags were kept inflated constantly in hopes of the wind going down.

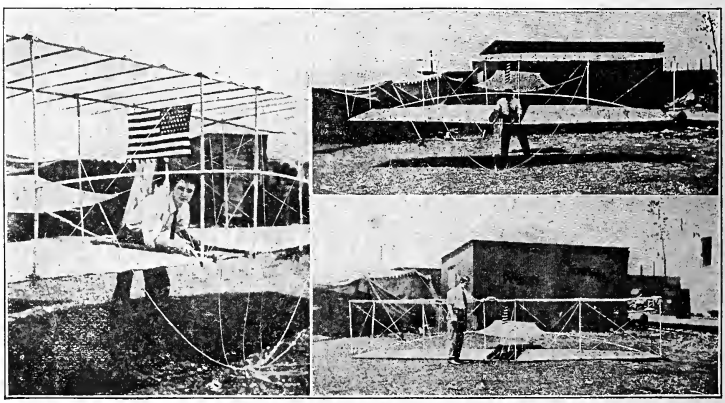
Mr. Lesh made one ascension in his



double deck glider which was 20 ft. long, 6 ft. fore and aft, with 200 sq. ft. of surface. The tail was 11 ft. long; the decks 4 ft. apart. We say "was" because the machine was wrecked by the storm on the last day.

On entering the grounds of the Aerodrome the first that attracts the attention of the sightseer is the various tents that cover the huge monsters of the air. The tents all seemed to be securely staked to the ground in order to hold the great gas bags from taking their flight. Near the side of each tent some tanks and barrels could be seen which formed the apparatus for making the hydrogen gas used in the gas bags. A combination of iron filings, sulphuric acid and a secret preparation makes this gas. A tube of cloth and about six inches in diameter conveyed the gas from the tanks to the gas bags. The gas bag is constructed of a very fine grade of silk which is sewed together in squares with strips of heavier material. It is then oiled with a preparation that will not get hard. From these great bags, which are about 55 or 60 feet in length and 20 feet in diameter, is suspended, by a network of fish line, a small three-cornered frame made from spruce sticks and braced with piano wire. On this light frame and near the middle is bolted the motor that drives the 16-foot propeller wheel. On the various types of airships this motor differed in style and construction, ranging from 6 to 40 hp. and 2 to 8 cylinders. A tank for gasoline as well as a small storage battery is attached to the light frame. A large frame made of spruce and covered with muslin and fastened to the rear end of the light frame forms the rudder. The daring aeronaut strides the light frame and when in midair controls the motor by a long rod along the frame and changes the course of the ship by guide ropes to the rudder and changing his position along the frame.

The entire weight of an airship is about 350 pounds, while the motors weigh from 96 to 165 pounds. The light spruce frame will weigh from 65 to 80 pounds. The propeller is placed at the forward end.



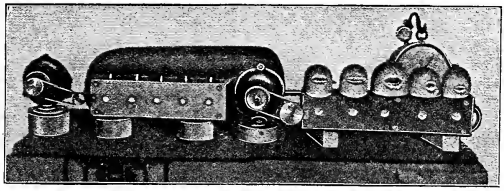
Views of Aeroplane Built By L. G. Lesh

INVENTED THE TELEPHONE

Another claimant for priority in the invention for which the patent rights were granted to Alexander Graham Bell was Moujeot, a poor and obscure Frenchman who has just died near Paris.

MACHINE PRODUCES VOWEL SOUNDS

The phonograph reproduces words or sounds, but the electric "siren" actually produces the vowel sounds. An electric motor compresses air in imitation of the human lungs and the operation of a keyboard causes the air to pass through the artificial mouths and lips which are cast from plaster of paris. These casts are shaped in exact imitation of the forms the human mouth and lips assume when speaking the several vowels.



Courtesy Scientific American

"An Electric Motor Compresses the Air"

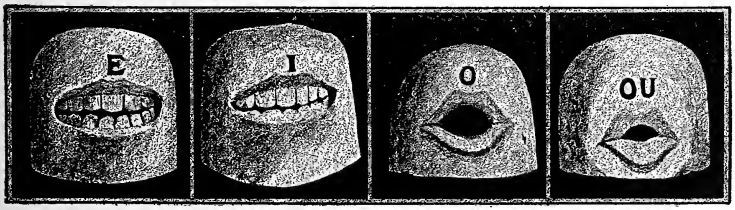
In addition to being an interesting invention capable of considerable development, the siren is used in testing the degree of deafness of an impaired human ear, as with the machine it is possible to register the exact amount of pressure required to produce a sound which the deaf person can hear. The invention is by Dr. Marage, of Paris.

Some curbstone brokers in New York are using wireless receivers instead of megaphones to get market quotations.

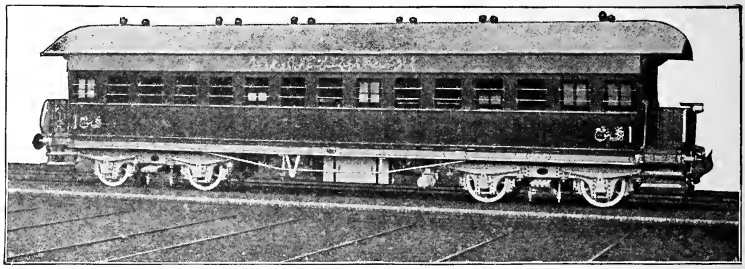
PROGRESSIVE LONDON

What is this? Did you never hear of the London ambulance service? Well, this is it. Don't laugh. London takes it seriously and is very proud of it. Inside the "dog kennel" is a stretcher on two wheels, upon which the victim of accident or sudden sickness can be jolted off over the cobblestones to the nearest hospital, enthusiastically accompanied by all the 'Arries and 'Arriets who can get near enough to feast their eyes upon the pale, distorted features. London is a great town and will have American police ambulances some day.

The bristles of any brush are kept in place by the tightness of the handle. Therefore any shrinking of the handle loosens the bristles, and it should always be kept in a moist place. The bristles of a paint brush should be immersed in water when not in use, but it should never be allowed to stand on the bristles; hang it.



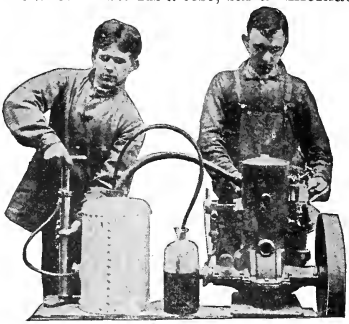
Plaster Cast Mouths for Speaking Vowels



Corridor Car for the Ottoman Railways

PREVENTS RUST FROM SALT WATER

One of the marine engine builders has discovered a process for preventing rust on the interior of water jackets of gas engines when salt water is used for cooling. The preventive is a secret chemical preparation which is pumped into the jacket under a pressure of 100 lb. One such treatment is supposed to make the iron immune to salt water rust. As a test, sal-ammoniac



Pumping the Chemicals

was injected and left in 6 weeks, but on removal and breaking the casting for interior inspection, no sign of rust was found.

The salt water gives little trouble in the way of rust as long as it is kept in motion, but where it remains unmoved for a few hours or days rust sets in and when once started increases rapidly.

GAS MOTOR CARS

Three-wheeled chairs carrying two passengers and the driver are proposed for the Boardwalk, Atlantic City. It combines the features of the hand-pushed rolling chair and the automobile. Power is supplied by a small gas motor.

OUR NAVY LEADS THE WORLD

The world's rapid-fire record has passed recently from the British to the American navy. The credit for this is due to Seaman J. L. Davidson, of the battleship Ohio, who put 11 consecutive shots from a 6-in. rifle through a 20 by 15 ft. target at a distance of 1,600 yds. in 51 seconds. The target was bobbing about continually in a rough sea. The best British record is the same number of hits in 60 seconds.

The Blue Jacket, an American naval publication, has the following by Margaret E. Schmidt in honor of the event:

England has her Dreadnaughts
With their deadly 12-inch guns;
Germany has battleships
Of twenty thousand tons;
Denmark, France and Italy
O'er great ships their flags unfurled,
But Uncle Sam has beaten all—
Our Navy leads the World.

OIL FUEL FOR FOG SIGNALS

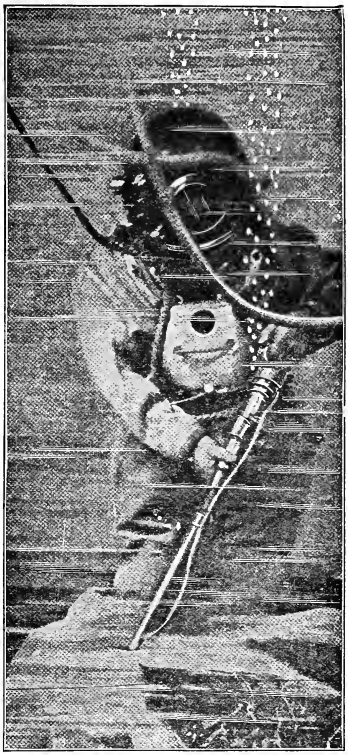
Until recently the United States Government has used coal for operating steam fog signals on the California coast. This consumption of coal is an important item of expense, even to the richest government in the world, for one "siren" alone — on the Farallone Islands, 25 miles west of San Francisco—eats up 100 tons a year. It has been decided to change the diet from coal to crude petroleum, in hopes of effecting a large saving of expense, so oil plants have been installed at five points where there are Government fog signals. Two other points are marked for the same equipment in a short time, if the results of the experiment justify further changes.

DYNAMITE BLAST SAVES SHIP

Divers Fight for Life With Great Devil Fish

On March 20 the big steamer "Northwestern" went ashore on La Touche Island, in Southeastern Alaska. The vessel was jammed in between two large hidden rocks, and was held fast as if in the jaws of a gigantic vise, and all usual methods of recovery would have torn big holes in the hull. A loss of $225,000 seemed inevitable to the insurance company. However, the British Columbia Salvage Company took the contract to float the great hull. This was finally accomplished through the agency of dynamite.

All the work was done by divers. First a survey was made of the submerged rocks, and a map prepared. It was then decided where to drill the holes for the blasts, and considerable time was occupied in this work. The drills were operated by compressed air, and each hole plugged as soon as finished, to keep out the sand. When all the holes were ready the dangerous operation of filling them with dynamite was performed. A much greater danger, however, threatened the divers at all times. The waters fairly swarmed with giant cuttle (devil) fish which constantly attacked the divers, who had many narrow escapes. In fact, the progress of the work was so slow on this account, and as the fear of the divers increased, it was found necessary to send them down in pairs. While one drilled the other protected him.



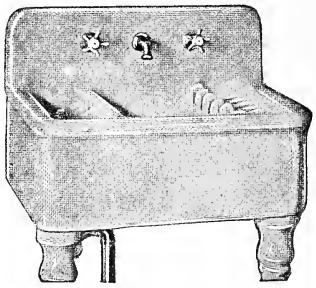
Diver Drilling Rock

So scientifically was the work planned and executed that when the explosion occurred the summit of the submarine mountains were torn away without injury to the ship.

England plans to build another Suez canal with British capital only.

NEW VEGETABLE SINK

A new vegetable sink for kitchens has three compartments. In one the vegetables are washed; in the middle com-



Three Compartment Sink

partment they are pared; the third contains clean water into which they are tossed until enough are prepared to transfer to the cooking utensil. The sink is made of porcelain.

A WIRELESS DREAM

Will fast ships speed across the Atlantic some day, carrying almost no machinery, and propelled by wireless waves of power generated at Niagara Falls? That is the dream of Sir Hugh Bell, president of Iron and Steel Institute, London. Who shall declare it impossible in the face of the wonders which the new century has already seen?

SEARCHLIGHT FRUSTRATES SUICIDE

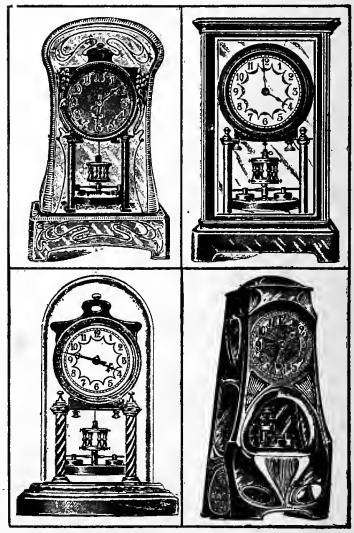
A young New York City woman who leaped into East river one dark night recently and was fast being carried toward the terrible rocks of Hell Gate was spotted by the searchlight of an express transport boat. As the woman's screams rang out, the searchlight was played up and down the waters, until at last it found and rested upon the white upturned face of the girl, who had been buoyed up by the skirts of a raglan coat she wore. Three men swam out from the shore and after a desperate struggle with the swift current brought her safely to terra firma.

TICKLESS CLOCK RUNS 400 DAYS

Primitive man had no need of clocks—he lived in the open air, awoke with the rising of the sun and went to sleep with the birds.

When more accurate precision was needed, he invented the sun dial, and that was followed for indoor use by the hour glass, and similar contrivances worked by water or sand. Wheel clocks worked by water followed. There was a striking clock in A. D. 807, and a large clock erected in London in 1325; but it was not till the introduction of the pendulum by Huygens about the 17th century that we got anything approaching accuracy.

And now the swinging pendulum clock with its regular beats ticking out



Courtesy Fisher, London

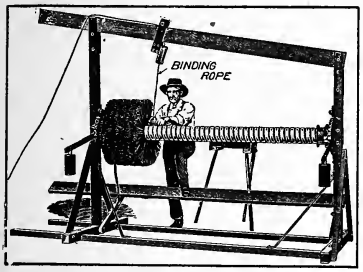
Types of 400-Day Clocks

the seconds is to become a back number. In its place is a pendulum which turns and returns in a horizontal plane, like the hair spring of a watch laid on a table, but unlike the watch gives out no sound—it is absolutely noiseless.

And it runs 400 days with one winding.

FILLING SWEEPER BROOMS

The illustration shows how to fill street sweeper brooms which have spiral grooves the entire length between hubs or sprockets in which the hickory fiber is fastened by Manila rope.



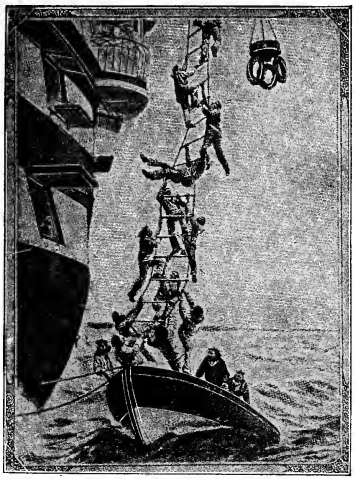
Making a Sweeper Broom

The broom spindle is placed in the frame, and the rope is passed through a tension on top bar of frame and attached to spindle. This spindle is connected with a treadle by means of a pawl and ratchet. Pressing down on the treadle with the foot winds the rope on the broom spindle, the material to be filled is looped around the rope, which is drawn into the grooves. The fiber should be dampened to prevent it breaking in being looped around the rope.

BEST TEMPERATURE FOR STORING FRUIT

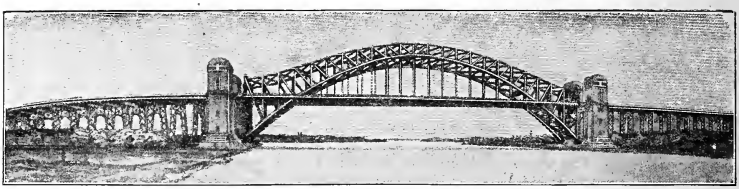
As there are nearly 1,500 cold storage plants in the United States which handle fruit of some kind, the best preservative temperature is a very practical question. Some experiments have been conducted in Maine from September to May, with a view to determining the comparative merits of artificial cold and cellar storage for fruit, especially apples. The average artificial temperature was 35°; of the cellar, 42°. Whereas all the Baldwins and Spies in the cellar had rotted in that time, only 13 per cent of Baldwins and 21 per cent of Spies had gone to the bad in the artificial cold.

It was found also that maturity of fruit and promptness of storage had great influence on length of preservation. For instance, Spies which were stored immediately lost only 21 per cent in the same time in which others which had lain ten days in barn before storage lost 49 per cent. Also firm, ripe apples deteriorated only 18 per cent as against 62 per cent of apples picked two weeks later from the same trees.



TRAINING FRENCH SEAMEN—In the French navy special attention is given to a systematic training which is calculated to make the men active and light of movement. The picture shows one of the lessons by which the sailors are taught to "man a small boat" quickly when a high sea is running.

To prevent glue cracking add a little chloride of calcium, which will absorb enough moisture to counteract excessive dryness of the glue.



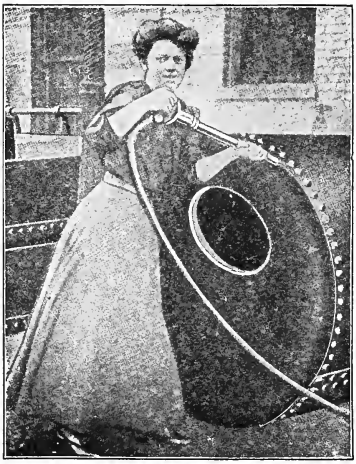
This Will Be the Largest Steel Bridge in the World

PROPOSED HELL GATE BRIDGE

A railroad bridge, which with its steel viaduct approaches will be three miles long, may be built over Hell Gate, N. Y. It will be the longest and heaviest steel bridge in the world, and will require 80,000 tons of steel. The four tracks will be 140 ft., and the top of the arch 270 ft., above the water.

YOUNG LADY BUILDS BOILERS

Chicago has a young lady boilermaker, the only one, so far as we know, in the country. She is Miss Ruth Kissack, 19 years of age, and, of course, good looking. Her father conducted a boiler shop for many years and Miss Ruth was his office manager the past three years, and for the year during her father's illness superintended the shop and had charge of the buying. She also learned the practical side of the work and can rivet up a boiler with pneumatic hammers as well as any of the men. Since the death of her father, which occurred several months ago, she has had entire charge of the business.



Courtesy Ideal Power

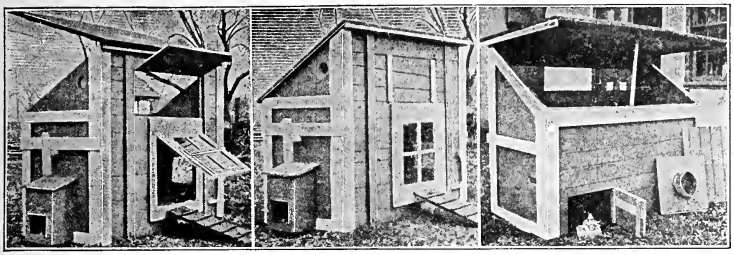
Chicago's Lady Boilermaker

NATURAL HOT WATER HEATING

People living in the western part of Southwestern Dakota are to be congratulated on having a never-failing supply of hot water for heating their houses and for other purposes. By drilling artesian wells they get spouters varying in temperature from 100° to 130°, and even higher.

INCREASE OF U. S. NAVY

The growth of the "big stick" will be watched by the American people with various emotions. Part will be elated by the fact that the Navy Department will soon have 8 new battleships well under construction, besides 7 cruisers, 5 destroyers and 4 submarines. Most of these will be ready for service this summer, and work is being pushed as fast as is consistent with thoroughness. Other Americans will be pleased to note that their country is not yet committed to the ruinous race for naval supremacy, in which France has 126 war vessels under construction, England 76, Germany 43, and Austria 33.



PIANO BOX BROODER HOUSE

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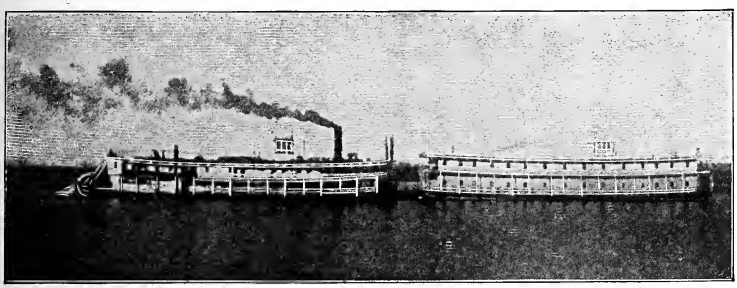
An excellent brooder house for chicks hatched in an incubator may be made from an upright piano box. The first operation is to saw off the top of the box diagonally, for proper slant of roof, on a line drawn from the division between upper and lower parts of the front, to a point near the top corner at the back, which makes the front of the piano box the back of the brooder that is to be. Then remove lower part of front of box and mark with a pencil around bottom of box on the inside, after which knock off bottom, and saw off edge on all four sides. The object of this is to bring bottom of box up inside the proper height, placed on well nailed cleats, to provide for heating apparatus underneath. Place hinged windows as shown in the cuts. The house will accommodate 100 chicks, but 50 to 75 will do better. Make the roof and sides watertight with tarred paper.

SUBSTITUTE FOR POSTOFFICE TWINE WANTED

The Postoffice Department would welcome some device or inexpensive appliance which could be used as a substitute for the jute twine now universally employed in tying letters in packages. The general public would hardly think of the amount of this twine required each year but it runs into big money. For 1906-7 the sum of $200,000 was appropriated to buy this twine and the fiscal year is not yet up and the stock of twine is all gone. For the current year 2,000,000 lb. will be used, or 900,000,000 yd. The twine can be used only once. Some tying device which would hold the letters in bunches for transmission in mail



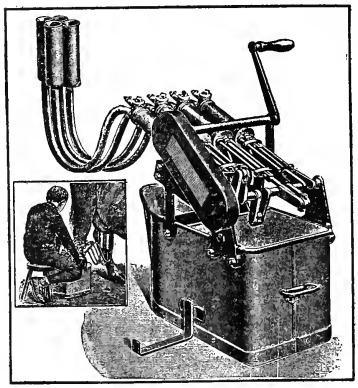
Courtesy Motor Boat

A floating theatre is one of the unusual things in water craft, but can be found on the Lower Mississippi river. It is a boat without power and is towed or pushed from town to town. The company live on the boat, which has an auditorium seating several hundred. One-night stands have no terrors for the merry company of sailing players.

pouches and do the work as well as twine would bring a fortune to the inventor.

NEW MILKING MACHINE

A very simple mechanical milker is being used in Europe and reports indicate better results than have been secured from any other of the several milking machines. It is so simple a boy 10 years of age can easily operate it. It consists of four pumps which work in succession, one after another, and at the same speed as a person milking by hand. Each pump is connected by a short rubber tube to a teat-cup, of which there are four. The milk has only a short distance to travel and discharges directly into the pail to which the machine is fastened. The operator sits on a stool and turns a crank at the rate of 45 revolutions per minute. The suction of any one of the pumps can be increased or decreased by turning a thumbscrew which controls the air passage. As soon as one teat is milked the suction is cut off and the cup removed, while the other pumps continue working. Where several machines are used in one place power through flexible shafting (1-10-hp. to each machine) may be used. With power one operator can superintend several machines. The device has been patented in all countries.

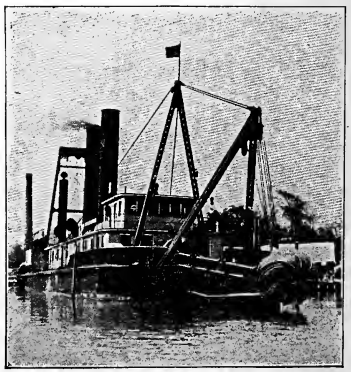


Simple Mechanical Milker

BIGGEST DREDGE IN THE U. S.

It is now at work off the north shore of Chicago, sucking up sand and clay from the bottom of Lake Michigan and passing it along through a 30-in. steel pipe to fill in a stretch of shallow shore a mile long. This strip has already been surrounded by a breakwater, and when filled in it will add 242 acres to the area of Lincoln Park. The value of the new land will be at least $4,000,000. For this extension work $1,000,000 have been appropriated and the commissioners will be able to keep within that amount by having their own dredge to do the work. Although the dredge will cost $148,000, there will be a saving of 20 cents a cubic yard from the 30 cents bid by private contractors, and when the work is finished the machine can be sold for a large fraction of what it cost.

This hydraulic pumping dredge is well worth seeing. The hull is steel, 150 ft. long by 35 ft. wide, and contains engines of more than 1,200 hp. From the bow projects a long steel beam, which can be raised or lowered and this supports the intake dredging pipe. At the end of the pipe revolves



The Big Dredge

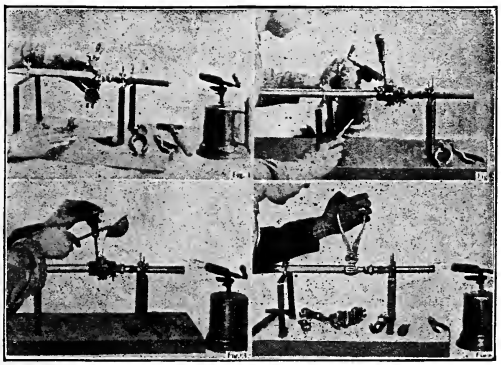
an enormous clay cutter, 7½ ft. across and weighing over 5 tons, of which a separate view was given in Popular Mechanics for June. As this cutter bores into the bottom, a powerful turbine in the hold of the boat sucks the loosened earth into the pipe and sends it out at the stern through a discharge pipe as far as may be necessary. The outlet pipe is in 100-ft. sections, connected by heavy rubber joints, and supported by steel cylinder floats, one on each side, and it will deliver a maximum of 1,500 cu. yd. per hour.

At the stern of the boat are two great "spuds" to hold it in position. They are solid cylinders of wood, 2½ ft. in diameter and 53 ft. long, each pointed with a steel tip weighing 12 tons; they can be lowered into the lake bottom either singly or together. By dropping first one and then the other, and swinging the boat on each alternately as a pivot, the dredge at the bow can be made to sweep a channel 175 ft. wide.

A WIPE JOINT MACHINE

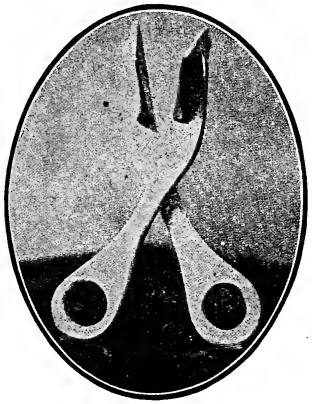
It does not make any difference if a man has had experience or not in wiping joints if he uses a wipe joint machine, as it can be operated by anyone of intelligence after reading directions. The illustrations show the machine in operation. The joints made by the machine are better than the hand-wiped, because the soldering metal is used at more extreme heat and it is a well-known fact that the hotter the metal the stronger the joint.

Brass fittings should be turned as usual and lead pipe scraped before being placed in machine. After applying the machine (Fig. 2) to the parts both should be heated with a blow torch on all sides until machine is hot enough to melt a small piece of solder laid in the trough for that purpose. The molten metal is then poured in as in Fig. 3. When cool the job is complete as in Fig. 4.



WASP KILLING SCISSORS

This unique instrument for killing wasps and other undesirable insects which may enter a house, was the invention of the late Lord De Ros, of England. The scissors are made of wood. The two handles can be whittled out of any soft wood, and the squeezers glued or tacked in place. Fasten handles with a small brass rivet.



"Made of Wood"

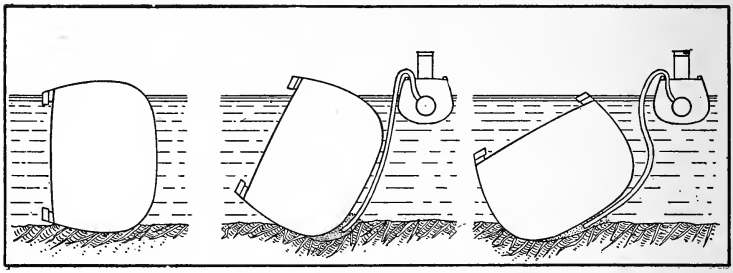
HOW THE "VARYAG" WAS RAISED

Remarkable Success of Japanese Naval Engineers

On February 9, 1904, the fast Russian cruiser "Varyag," 6,500 tons, was driven from the neutral harbor of Chemulpo, and after engagement with the Japanese fleet was riddled with shot and sunk by her commander. For thirty months she lay on the bottom, deep in mud which partly filled the ship, then was brought to the surface and is now in service in the navy which sank her.

The event is extremely interesting as the most notable success of its kind, and accomplished under difficulties which were pronounced impossible to overcome. Not only was the hull nearly buried in mud, but a 5-knot an hour current made the work of the divers slow and dangerous. Two months were spent in uncovering and stripping the wreck of as much armament as possible. The hull lay on one side, with the keel on a horizontal, and the first steps were to turn the ship over and bring it on its keel. This was done with jets of water forced under one side, which dug out a sort of ditch into which the hull gradually slid until at last it was in a vertical position. The big guns were then hoisted. Usual methods of closing the holes failed and a shell or outer vessel inclosing the wreck had to be constructed to completely envelop it. Three large pumps, built in Japan for the special purpose and capable of pumping 3,600 tons of water per hour, were installed on big floats over the wreck and connected to auxiliary vessels for steam supply. On August 8, 1906, an unusually high tide was running and the effort was made. In a short time the hull had reached the surface and repairs were made to hull and machinery which permitted the extraordinary feat of sailing to a Japanese port under its own steam and power.

In the work were engaged, in addition to the officers and divers, about 300 Japanese naval mechanics and as many Korean helpers. The cost, including the three big pumps, was about $500,000. Had the same methods been adopted it would seem that the raising of the "Maine" would have been a task easy in comparison to the recovery of the "Varyag."



"Jets of Water Dug out a Sort of Ditch"

ACID-PROOF PIPES

Iron pipes lined with lead or tin are made for the transmission of acids which would quickly destroy unprotected iron. These pipes are made up to large sizes; one copper smelting company, for instance, has 30,000 ft. of 10-in. pipe lined with lead which has been in use 12 years.

Never let any soap-suds fall upon your eye-glasses — one drop will ruin them. The caustic alkali will make the glass iridescent.

PEARLING AND PEARL-DIVERS OF TODAY

How Men Walk the Sea Floor in Search of Huge Shells with Costly Gems

By William George Fitz-Gerald

Steam Lugger—Pearl Diver Coming Up

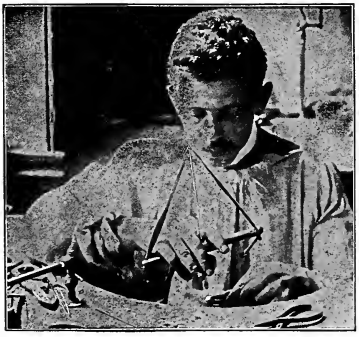
Pearl-diving suggests to our mind much that is romantic; but the era of naked divers, in dire peril from sharks, has passed away; and modern progress now equips the pearler with a fearsome-looking suit of India rubber, glistening copper breastplates, with great leaden weights back and front, and lastly an uncanny-looking helmet, glass-paneled and with elaborate telephonic attachments; air-pipes, life-lines and a powerful submarine searchlight, carried on steam luggers.

Thus equipped the pearl-diver of today may spend six or eight hours at the bottom of the sea, whereas in olden times three minutes made a record. Although pearls are found in nearly all molluscs, and even in univalves like the Australian Haliotis—a kind of barnacle—true pearls are only produced by the pearl oyster, or mother-of-pearl shell. And, by the way, the commercial "M. O. P." shell is really the diver's bread and butter. They are as big as an ordinary dinner plate and weigh 2 lb. when cleaned. These fetch from $500 to $750 a ton in the market and all the world knows that mother-of-pearl is a staple commodity of trade.

The pearl-fishers are aware that shells infested with living parasites are most likely to yield fine gems. The ancient fisheries were chiefly in the Indian Ocean and Persian Gulf; but nowadays the loveliest and most perfect pearls come from Ceylon, and above all Australian waters — especially Torres Straits and in various little-known spots in the remote Arafura Sea.

Pearl-fishing in Ceylon is a government monopoly, controlled and directed by officials; and in the month of March the fleet starts for the pearling grounds, each vessel with 20 or 30 divers and their assistants. But you will find the headquarters of pearling in the desolate country extending from Exmouth Gulf to King Sound, in Western Australia. A glistening white coastline is this, whose monotony is broken only by mangoe-fringed salt-water creeks and scorching deserts of spinifex and sand.

Here, then, we have 600 odd miles of coastline with perhaps 5,000 hardy adventurers engaged in the pearl trade. There are besides some thousands of Japanese, Manila men, Malays and men of other races, acting chiefly as crews for the little ships which so often run



Drilling a Pearl

on uncharted rocks in those far-off and little known seas. The vessels are schooner-rigged and from 7 to 14 tons burden. Each carries a master diver and a crew of four, one of whom officiates as the diver's assistant and works the cylinders and cranks of the air-pumps that supply him with air while he is below. Meanwhile the lugger drifts with wind or tide while busy gloved hands are groping for the huge shells amid great swaying, many-colored forests, 20 fathoms down in the tropical sea.

One man above holds the life-line and pays attention to signals; another is catching fish or peeling potatoes for the dinner; and it may be a third has gone off in the dinghy for fresh water and firewood. The shells are found on ledges about 90 ft. down in the sea, but it is common knowledge that they are far more plentiful at greater depths. Vast fortunes await the inventors of a diving apparatus which will enable the pearler to work in comfort at 100 fathoms deep. It should be borne in mind that even at 200 ft. the diver endures a pressure of 88 lb. on every square inch of his body!

The lugger has a dangerously low free-board to allow of the diver, with his heavy dress and gear, being easily hauled on board. He carries a net with him holding the shells, and when this is full he has it hauled up so that he himself may run no risk of entangling life-line or air-pipe. You could not imagine an environment more weird than that in which the fully-dressed pearler works at, say, 20 fathoms. He moves airily, notwithstanding his 40-lb. boots, amid groves of coral trees, interlaced with fluttering fern-like plants, among whose branches swim gorgeous tropical fish and sinister water-snakes, who seem to resent the intrusion of so strange a monster.

A good day's work is anything over 200 pairs of shells, although I have known as many as 1,000 picked up in that time. The business, as may be supposed, is absolutely speculative. One diver may open ton after ton of shells without securing anything of greater value than a few seed pearls, while another may take a fortune out of a day's gathering. The most famous pearl discovered in Australia of late years is that known as the "Southern Cross." It consists of a cluster of nine superb pearls in the shape of a small crucifix, almost perfect in proportion. This curious freak of nature was picked up at low water on the Lacipede Islands by a "beach-comber" named Clark, who, after burying it for some time for superstitious reasons sold it for $50; it fetched $50,000.

The pearl diver of today, protected as he is by every device known to modern submarine engineering, is liable to many perils. He may lose his life by the ripping or tearing of his dress upon the sharp coral rocks through which he picks his way. Then, should an accident happen in the lugger above, his air supply may stop, in which case he is suffocated; a crew of Malays, by the way, can never be depended upon. Therefore, you may be sure the man below has an uncanny feeling sometimes, a feeling of utter loneliness and helplessness causing him to start sharply at the sudden appearance of a dark mass of rocks, or the unexpected touch of a clammy sea-finger.

He finds himself far from human aid—out of the world, as it were, where every form and creature is different from those on earth. Nor is his occupa-

tion healthy. It predisposes to deafness and rheumatism and may affect the lungs and heart. The worst enemy the Australian pearl-divers have, however, are the terrible cyclones that annually visit the coast. As to sharks, they rarely attack a diver in modern dress, and he can always frighten them off when they persist in following him by letting a few air bubbles out of his dress. Other enemies are the black and yellow sea-snakes, the smaller octopus, the stingray and the blow-fish.

After a day's take of shell has been conveyed ashore the shell-opener gets to work at once. The pay of these men equals $30 a month plus 10 per cent on the value of the pearls found. Some idea of the magnitude of the industry may be realized on learning that last year 520 luggers paid an annual $5 license to engage in the trade, and they took many thousands of tons of pearl shell; the customs duties in the tiny pearl town of Broome exceeded $5,000 a month.

The treasury authorities of Western Australia estimate they receive at least $100,000 a year in dues from the pearlers. But of course the industry is enormously profitable and hardly a month passes without the discovery of these "tear drops of the ocean" having a market value of from $5,000 to $15,000 each, and sometimes much more. Thus a beautiful pink pear-shaped specimen weighing 206 grains was found last season and sold for $80,000.

Before setting, pearls are classified according to size on a setting board; and the delicate work of drilling a valuable specimen is invariably done by an old-fashioned hand apparatus. Moreover, no matter how valuable a set of pearls may be, they are invariably strung on fine silk thread. One extraordinary fact is that unless pearls are worn they will pine away and die. Thus, in the Louvre Museum in Paris at this moment you will see a superb pearl necklace *on its death-bed!*

To be precise, it lies on a velvet cushion. This is the famous necklace left by M. Thiers, diplomat and statesman; it

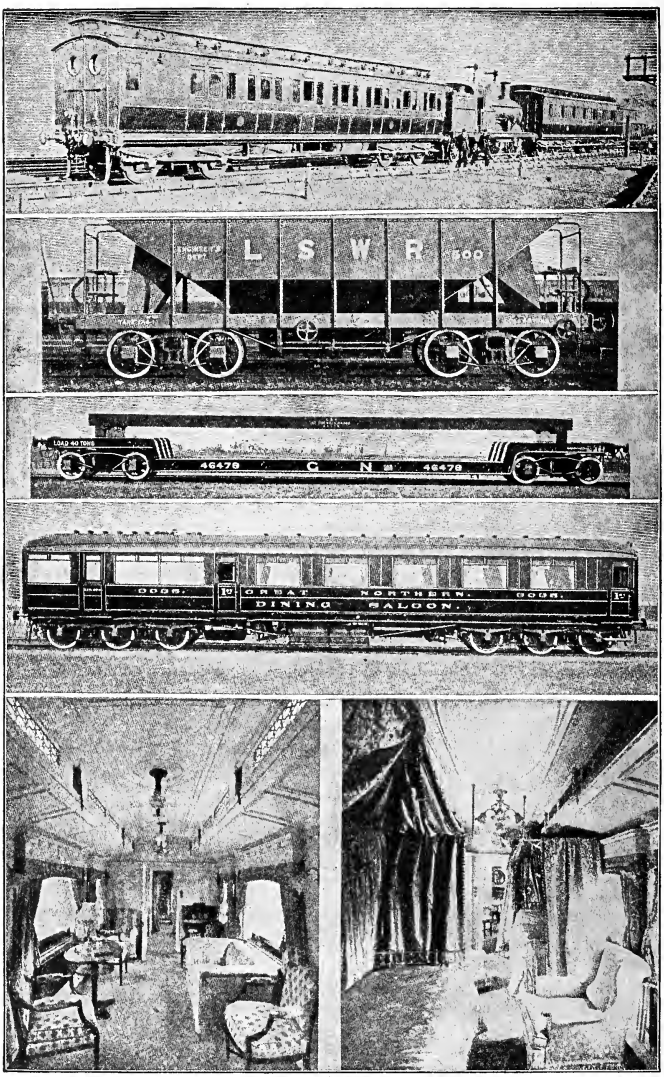
The Pearls Are Strung on Silk

formerly belonged to his wife, and was once worth $300,000. It consists of 145 pearls in three rows, weighing altogether 2,907 grains. The once lovely gems, however, are fast losing their luster, and in a decade or two will turn jet black and become quite valueless. The authorities in the Louvre view the matter with grave concern; but they are well aware that little can be done unless the decay of the gems can be arrested by their being worn on warm human skin, so sensitive are they to change of temperature.

CAN'T CHANGE BOAT'S NAME AFTER 20 YEARS

After 20 years the name of a vessel registered in this country cannot be changed unless it be rebuilt at a cost of at least one-half the original cost.

A navigation company on the Great Lakes is in an unusual predicament. It recently put on a new steamer named "City of Cleveland." The company has an old steamer of the same name which they changed to "City of St. Ignace," only to find to their surprise that they had collided with a Government regulation which forbids the name of a vessel to be changed after being carried longer than 20 years, and the older boat was named in 1886.

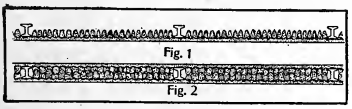


TYPES OF ENGLISH CARS.—The above illustrations are selected from a large number of views used by the president of the English Institution of Mechanical Engineers in his annual address. The first is a two-car Irish train which operates with the locomotive between the cars. The second is a standard ore and coal dump car. Next is a car for transporting large steel girders of 40 tons. The dining car is 65 ft. long and weighs 39 tons. The two lower views show the interior of the Queen's private car.

A STRONG THIN PARTITION

In buildings where space is so valuable that every square inch is worth many dollars, very thin partitions which are at the same time strong, impervious and fireproof are at a premium. Such partitions are now built only $1\frac{1}{4}$ in. thick, yet amply strong enough for all ordinary uses. Of course they do not carry doors or windows.

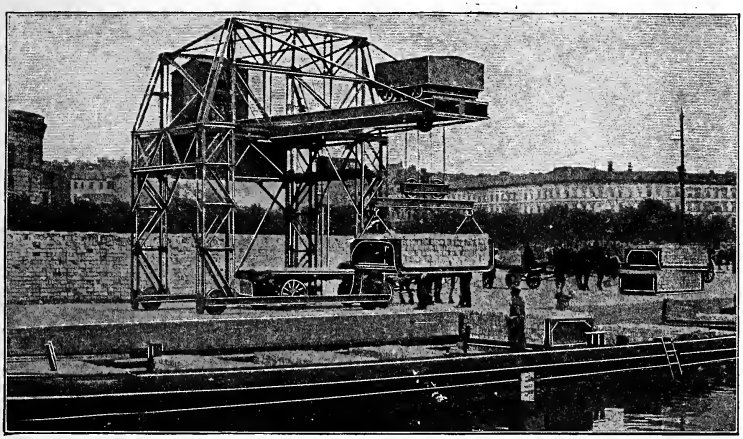
Small I-beams of steel about 1 in. in width are used for the studding, to which is wired the metal lath. These I-beams are set about 14 in. apart and can be of any length suitable for the height of the room. In the illustration Fig. 1 shows a partition in cross section as it appears with plaster pushed through the meshes in the metal lath.



In Fig. 2 is shown the plaster on both sides of a partition and how the plaster interlocks between the metal lath and forms what is practically a solid concrete wall. This makes a partition not only thin but solid and impervious to ordinary sounds.

ELECTRIC BRICK HOISTING CRANE

Brick and canals suggest ancient history, and electric power stands as the crowning genius of the new century; all three are linked together in one of the large industries of Germany.



Electric Crane Lifts a Wagon Load at a Time

The brick yards of Berlin are situated along canals not many miles out from the city, says the Western Electrician, and the transportation of the brick by water is found least expensive. The brick are loaded into steel crates holding 1,500 each, which are loaded into canal boats using storage batteries for power supply. Each crate is a wagon load and each boat holds forty crates. When the boat reaches the city dock, a great electric crane reaches down and lifts a crate with its 1,500 bricks up and out and sets it down on a wagon on which it is carted to the place where the brick are wanted. Could anything be quicker or simpler? The entire boat load is taken out in less than three hours.

AN ELECTRIC BLUEPRINTING MACHINE

Where a number of small prints of the same size are made from tracings during cloudy days and winter conditions it is a long and tedious job. Usually such prints can be made in 8 by

Electric Blueprinter

10-in. frames, such as are used by photographers.

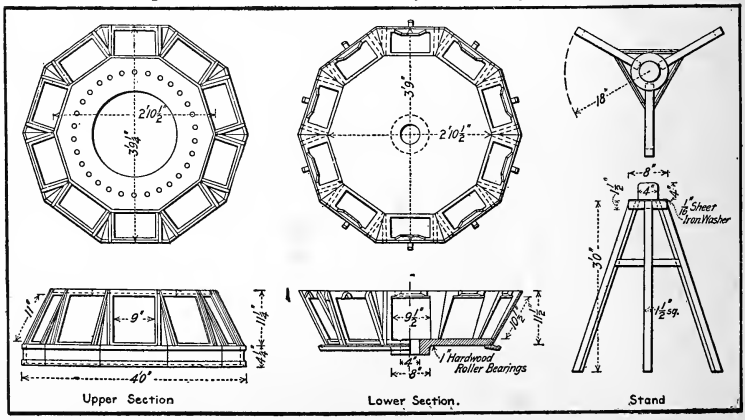
Mounted upon a tripod, having an arbor at its apex, is a 10-sided drum with flaring sides, having a hub with wooden rolls, upon which it revolves around the arbor; in this drum are 10 apertures the size of the inner face of the printing frames, says Engineering News. A rabbeted extension at the bottom holds the lower part of the printing frame while a brass spring engages and holds the top of same, as shown in accompanying illustrations.

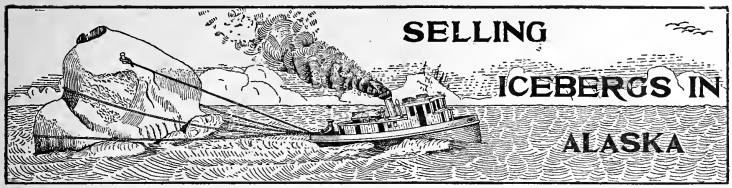
Fitting on to the lower drum is a similar one with receding sides, but without the extension and the springs, as the frames remain fixed on account of their position.

This makes provision for 20 frames and each one is equal distance and at the same angle from the lamp, which is suspended and projects down through a hole in the upper drum and is centered by means of a plummet over the center of the arbor on the top of the tripods. The distance from the center of the flame to the center of the glass in the printing frame is 22 in.

The lamp may be of the ordinary direct-current arc light with enclosed clear glass globe.

Rust may be removed from iron or steel utensils in many ways. If recent, rub with an oil-soaked cork; or, rub with oil of tartar or with very fine emery and a little oil, or with strong alum and vinegar, or soak in turpentine or kerosene over night and clean with very fine emery cloth.





Icebergs are a drug on the market in Alaska—that is, in the winter time, when 40 degrees below is a mild day; but one of the strange perversities of nature is to burn and blister with a hot sun during the few weeks of Arctic summer. Juneau and one hundred other enterprising Alaskan cities now have well-equipped cold storage warehouses, better than most towns of equal size down in "the states," but there was a time when ice could not be had even in Alaska. It was during the second year of the Klondike fever and the Cold Storage and Ice Trade Journal relates the unusual manner in which a supply was found.

Berney Moran was certainly versatile. He had been a newspaper writer, tracklayer, section foreman, street-corner preacher, miner, walking delegate and a dozen other things. He rejoiced in the nickname of "Casey," and is now a wealthy mine owner. When Moran landed in Juneau he had a dollar bill and a thirst; the latter he proceeded to trade off for the former. The beer was served almost warm.

"Where's your ice?" asked Moran.

"We ain't no fancy dudes," was the frontier answer. "We never have no ice here in summer. You'd better drink your drink without ice or noise."

"Casey" Moran

"Say," asked Moran, "what will you give me for a constant supply of the best ice you want all this summer.

They dickered and came to an agreement, and Moran then visited the different saloons and markets and stores selling perishable goods, and made an arrangement with the majority of them to supply the summer's ice, an arrangement which few, if any, deemed he could keep.

Moran next hired a tug—on credit. He also hired an old warehouse on the shore. With a crew of two and himself and with a cargo of ropes, cables and anchors, he left the port and proceeded to sea.

Two days after the entire town of Juneau was down on the shore. A tug boat was approaching with a tow the like of which no tug boat ever had before. Fastened by a series of cables, ropes and anchors to the tug, and a hundred yards or so behind it, was a gigantic iceberg. On the berg Moran had sunk posts and fastened anchors, and finally managed to get a good towing grip. He gradually towed the mountain, composed of the most beautiful and clearest ice in the world, into the harbor, and stranded it in the deep water not more than fifty yards from his ice house.

Next day, in letters 10 ft. long, the following sign appeared on the old warehouse, thus establishing the first ice and cold storage business north of Fifty-three:

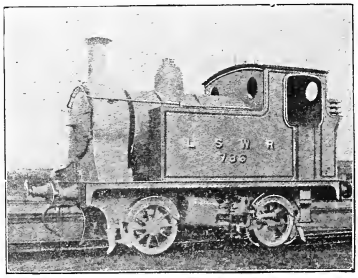
CASEY MORAN,
ICE
BY THE POUND, TON OR BERG.

A young lady in street costume made a balloon ascent at Belleville, N. J., recently, because she wouldn't take a dare. At a height of 1,300 ft., having crossed a river in the flight, she dropped with the aid of a parachute and landed safely. Then she fainted.

Deposits of meerschaum have been found in New Mexico.

NEW SUBURBAN LOCOMOTIVE

A new type of suburban locomotive for light trains on short runs is being built in England for use on the London & Southwestern Railway. It is mounted on four 3-ft. drivers, has no tender, is



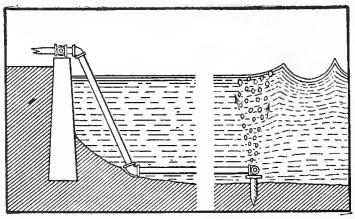
English Tank Locomotive

19 ft. long, and weighs 24 tons with 500 gal. water and 1 ton of coal.

On the top of the cab are two pulleys through which ropes pass from the throttle to the coach. When only one car is drawn the crew consists of two men, the engineer and conductor, and when the train is running car first the conductor can stop or start by working the ropes. The engineer does his own firing.

WILL COMPRESSED AIR STOP WAVES?

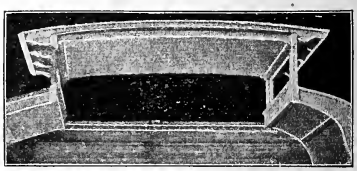
Instead of casting oil on troubled waters, it is proposed now to break them up with compressed air. Theoretically it seems feasible. A wave is most dangerous at the instant it breaks, releasing tons of water, it may be, to fall from a height of many feet with crushing force. If, then, the wave can be broken up before it strikes, it is rendered practically harmless. It is proposed to do this by running out a pipe with many minute holes at the end, through which air may be pumped under water to protect a breakwater, a helpless ship, or a light-ship. So far the only practical application of the theory which can be cited is the alleged effect of the compressed air rising to the surface of the Hudson river after escaping from the tunnel beneath. It is claimed that this breaks up all the waves in the vicinity. But that is far from conclusive, and it remains to be demonstrated that compressed air, apart from the question of expense, will be any more effective than a few cents worth of petroleum.



Pipe Has Minute Holes

STREET CARS WITH TWO ROOFS

Street cars are now being built with a double roof—the upper one an inch above the other and projecting 8 in. on either side. The purpose is to prevent leaking when cars are kept out of doors for want of storage room. The double roof also reduces the humming noise of the trolley wheel.



Courtesy Elec. Traction Weekly

Water-Tight Roof

It is not generally known by retail pipe dealers or by many users of pipe that any size of standard wrought iron welded pipe above $1\frac{1}{4}$ in. will just fit in the next size larger. This is so up until 6-in. is reached, when the sizes are made only in full inch numbers; that is, they jump from 5 to 6 and from 6 to 7, etc.

HOW YOUNG MEN ARE TRAINED FOR THE AMERICAN NAVY

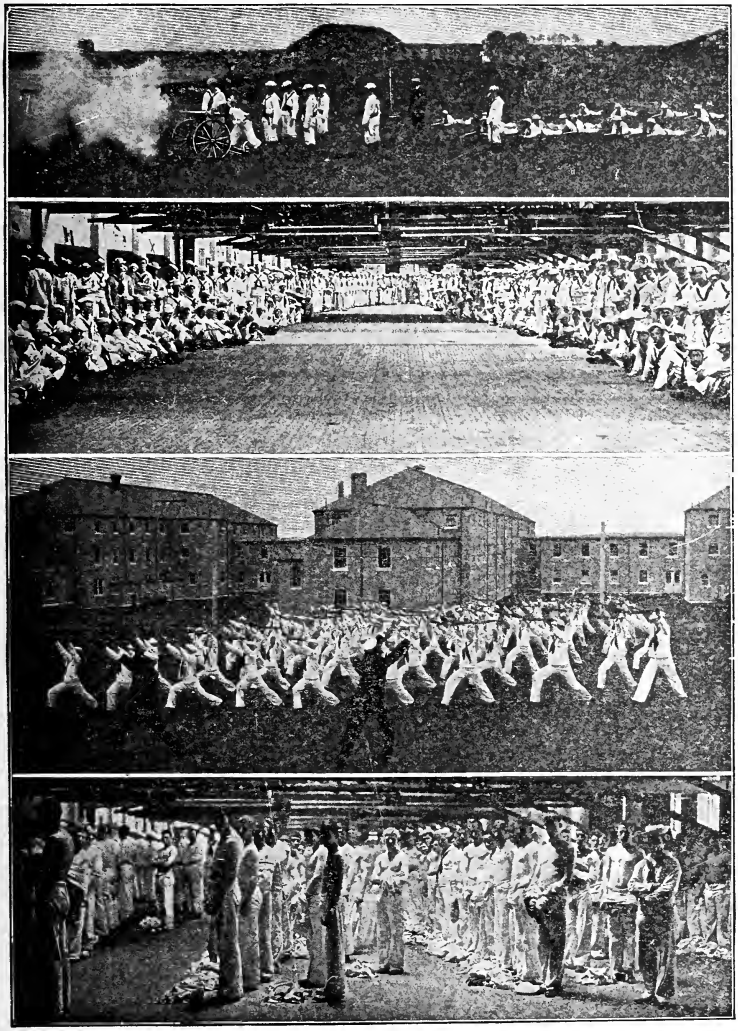
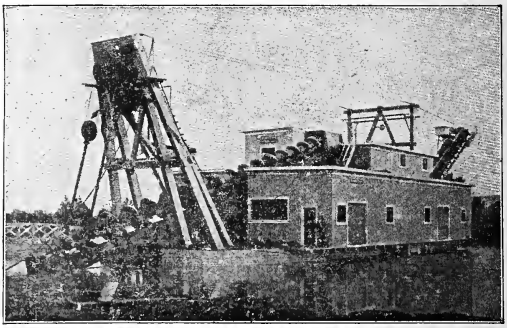


Fig. 1—Apprentice Seamen Drilling With Rapid Fire Gun Supported by Infantry. Fig. 2.—Interior of Drill Hall, U. S. Naval Training Station. Fig. 3.—Drill Under Arms at Newport Training Station. Fig. 4.—Physical Inspection.

GOLD DREDGING IN THE DESERT

Gold-hunger has drawn men everywhere except, perhaps, to the shifting sands of the Mojave desert. But now a mining company, recently organized in the southern part of California, proposes to dredge the dry bed of a prehistoric Mojave river for the precious yellow grains.

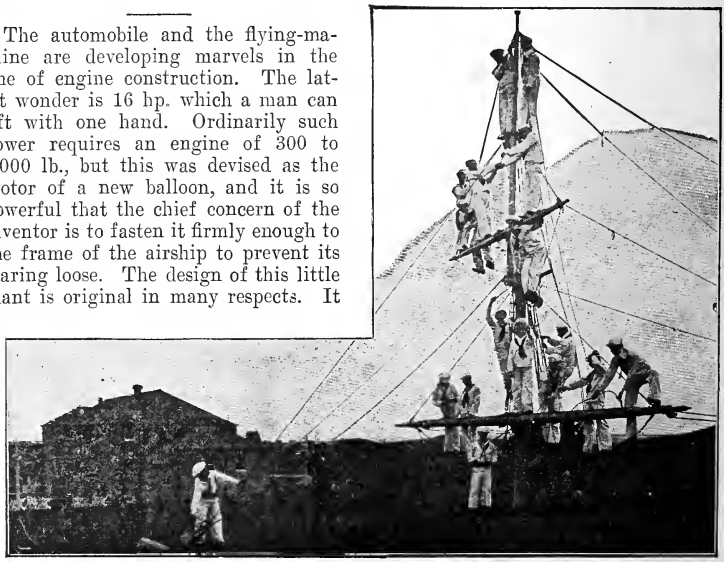
There is nothing new in the idea, for mining experts have long declared that the sands of the Mojave were well salted with gold; but how to get it? Now that problem has been solved by the drilling of several artesian wells whose overflow, after being pumped four miles, will be amply sufficient for dredging purposes.



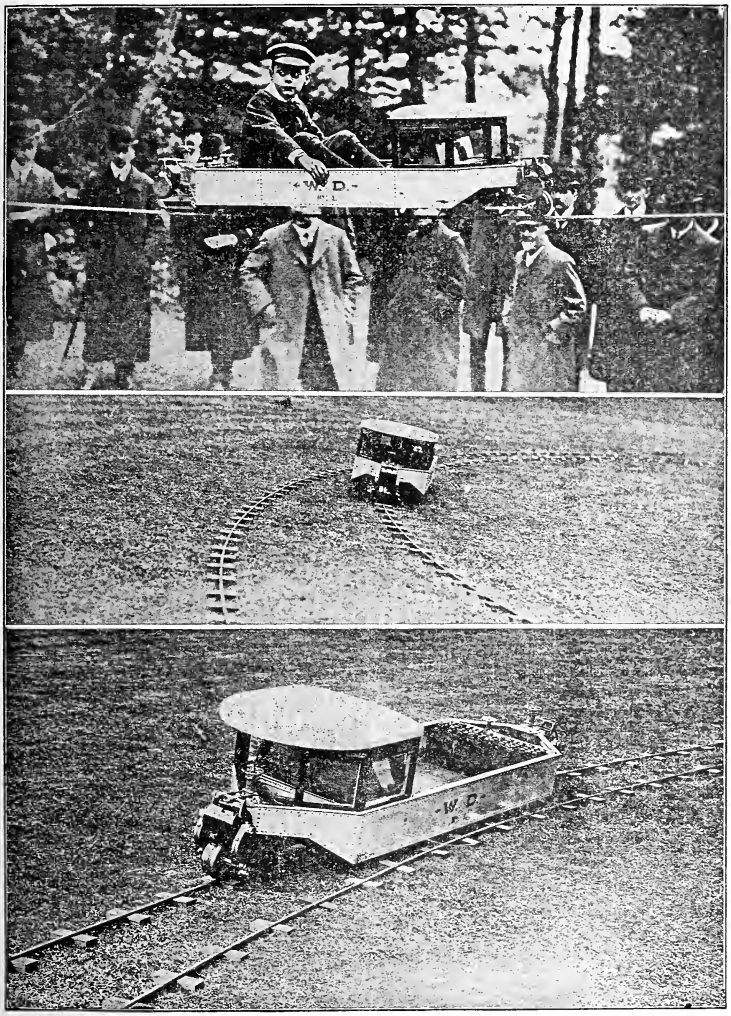
Dredging in a Desert

16-HP. FROM A 54-LB. ENGINE

The automobile and the flying-machine are developing marvels in the line of engine construction. The latest wonder is 16 hp. which a man can lift with one hand. Ordinarily such power requires an engine of 300 to 1,000 lb., but this was devised as the motor of a new balloon, and it is so powerful that the chief concern of the inventor is to fasten it firmly enough to the frame of the airship to prevent its tearing loose. The design of this little giant is original in many respects. It is two cycle, starts absolutely without fuel after half a turn, and runs without any carbureter. The spark coil contains, instead of the usual two windings of wire, six windings, of which the last five are looped in series with a battery of condensers. The lubricating oil is injected along with the gas mixture.



Seamanship Work on a Land Mast—U. S. Naval Training Station

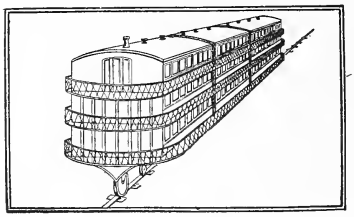


"The Car Maintains Its Balance Whether Standing Still or Moving"

CARS BALANCED ON SINGLE RAIL

Travel at 150 Miles an Hour—Predicted Greatest Mechanical Sensation in Years

Louis Brennan, an English inventor, has astounded the scientific experts with his demonstration before the Royal Society. Brennan is no ordinary dreamer, for the British government paid him $550,000 for his patent torpedo, and is now spending $25,000



Car of the Future

building a monorail car 12 ft. wide, under the direction of the war department. Indeed the inventor predicts the railway car of the future will be several times as wide as now, and two or three stories high. It will travel upon a single rail, and cross rivers on a single steel cable if conditions do not favor the use of piles or piers. The propelling power may be steam, electricity or gasoline. If Brennan's expectations are realized his system will revolutionize the operation of railways throughout the world.

Monorail systems are not new, but heretofore the cars have either been suspended, or held in poise by guide wheels on each side of the carrying rail.

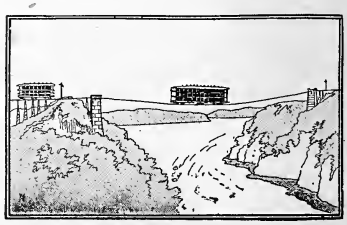
The secret of the Brennan system is the use of a gyroscope within each car. He has studied this mysterious piece of mechanism for 30 years and is said to be one of only three men in the world who really understand it. He says:

"The characteristic feature of the system of transportation is that each vehicle is capable of maintaining its balance upon an ordinary rail laid upon ties on the ground, whether it be standing still or moving in either direction at any rate of speed, notwithstanding the center of gravity is several feet above the rail and the wind pressure, a shifting load, centrifugal action, or any combination of these forces may tend to upset it.

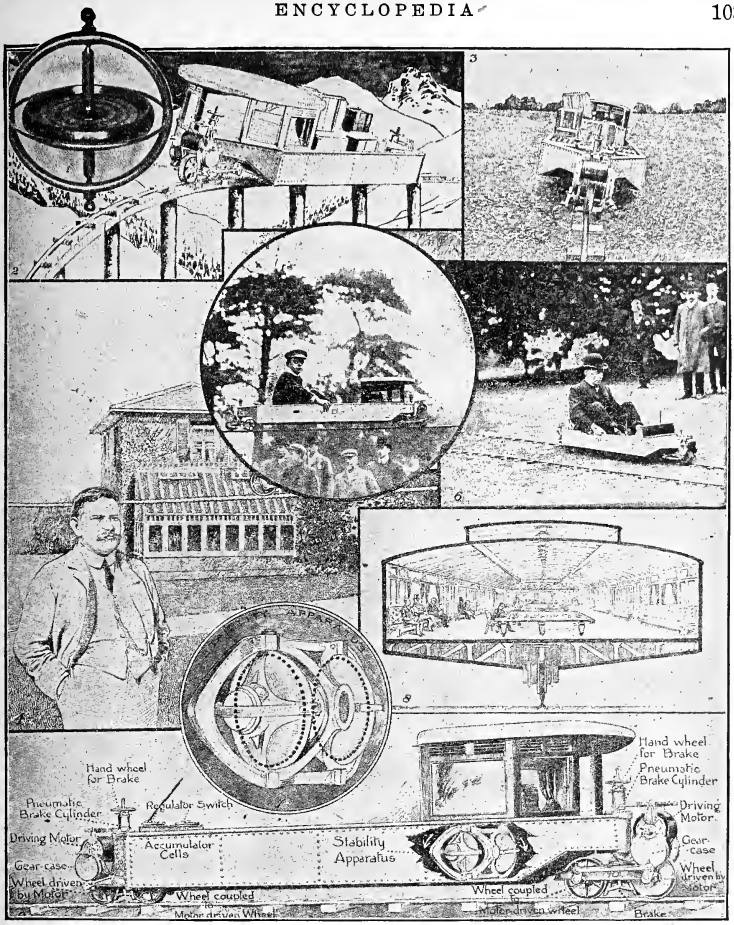
"Automatic stability mechanism of extreme simplicity, carried by the vehicle itself, endows it with this power. The mechanism consists essentially of two flywheels rotated directly by electric motors in opposite directions at a high velocity, mounted so that by their gyrostatic action their stored up energy can be utilized. These flywheels mounted on high-class bearings are placed in air exhausted cases, so both air and journal friction is reduced to a minimum, consequently the power required to keep them in rapid motion is extremely small.

"The wheels are placed in a single row beneath the center of the car and are carried on bogies or compound bogies, which are not only pivoted to provide for horizontal curves in the track but for vertical ones also. By this means the cars can run upon curves even of less radius than the length of the vehicle itself, or on crooked rails, or on rails laid over uneven ground without danger of derailment.

"The motive power may be either steam, petrol, oil, gas, or electricity. I use petrol (gasoline) and an electric generating set carried by the vehicle itself to supply the current to the motor's stability mechanism.



Crossing a Chasm



1. The active principle of the Brennan car: The Gyroscope in its simplest form, as it is sold for a toy—"The top that can't be knocked over." 2. The vehicle on the part of the track representing a mountainous district, showing the way in which it leans automatically towards the center in rounding a curve. 3. The vehicle on level ground, showing the way in which it leans automatically away from the heavier side when it is unevenly loaded. 4. The inventor at home. 5. A Blondin feat: The car crossing an iron hawser in the 6-ft. working model in Mr. Brennan's grounds, 5 ft. from the ground and keeping perfect balance. 6. The model car carrying a 150-lb. man. 7. The Brennan gyroscope. 8. Mr. Brennan's idea of travel in the future: A monorail vehicle very much larger and wider than present-day railway carriages. 9. Detail of the car.

"Everything points to a great economy resulting from making the cars wider in proportion to their length than on ordinary railways. Therefore it has been decided to make an experimental coach 12 ft. wide. Brakes capable of being operated by pneumatic or manual power are provided for all wheels.

"The rail only requires to be of the same weight as one of the rails of an

ordinary line in order to carry the same load on the same number of wheels in each case. The ties also only require to be one-half the usual length.

"The bridges would be of the simplest possible construction, a single wire hawser stretched across a ravine or river being all that is necessary for temporary work. Strange to say, the lateral swaying of the hawser does not disturb the balance of the cars, and the strongest winds will fail to blow them off. In other cases for bridge building a single row of piles with the rail on top suffices, or a single girder carrying the rail may be conveniently used.

"The speed can be from twice to thrice that of ordinary railways, owing to the smoothness in running and the total absence of lateral oscillation."

Sir Hiram Maxim, while admitting the success of the demonstration, pronounces the apparatus "a highly scientific toy," but does not believe the same results will follow when the system is applied to actual practice with standard size cars operating out of doors, and states:

"I think his plan to keep the carriages from tipping by the action of the gyroscope will be beset with a great many difficult problems, so difficult, in fact, as to make the whole scheme absolutely impracticable.

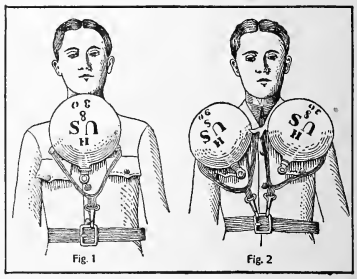
"It is quite safe to say that if Brennan's trains were running east or west and there was a strong wind from the north, the wind would exert considerable force on the train in the same direction, and I think that, under these conditions, the plane of the gyroscope would gradually yield, capsizing the train.

"No doubt there is nothing in the world so much of a mechanical paradox as the gyroscope. Perhaps I can best illustrate the construction, 30 years ago, by Sir Henry Bessemer of a ship with its cabins fitted with gymbals. He proposed to keep the ship in a horizontal position by the use of large gyroscopes. They had no effect at all in steadying the craft."

On the other hand Brennan operated his small car with one side greatly overloaded, and claims that in proportion to size of car and its unbalanced load, any wind pressure short of a hurricane would be no more severe test to a car of ordinary size. What can be done under actual working conditions will remain a question until the government makes the test. Until then the subject will continue to be one of absorbing interest to engineers and scientists, some of whom pronounce the invention the "greatest since the electric motor."

CANTEENS AS LIFE PRESERVERS

A novel use of the canteen is to employ it as a life buoy or as an aid in learning to swim. The accompanying sketch shows the position of the canteen as it should be used. Whether there is one canteen or two, the idea is practically the same. Snap the canteen strap to the belt buckle and fasten the



Emergency Life Buoy

canteens upon the breast so that they cannot slip out of place, says the Journal of the American Cavalry Association. This may be accomplished by fastening a string or handkerchief to the side rings of the canteens, and then passing it around the neck. For still greater security, pass a cord around the body and fasten it to the outside rings.

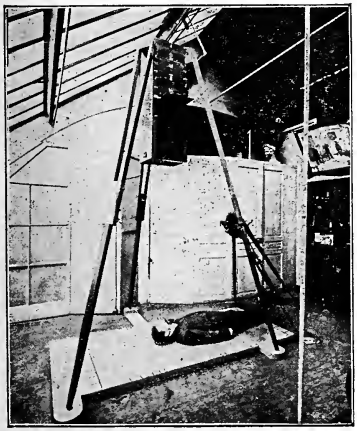
By the end of the year trolley lines will connect Chicago and St. Louis, and it is planned to extend the road to Kansas City.

BERTILLON'S NEW SYSTEM OF PHOTOGRAPHING THE DEAD

M. Bertillon, whose system of identification of criminals has been adopted in all parts of the world, has just invented a new form of photographic apparatus. It is used in making photographs of the dead. The result of the present method of taking the picture of a dead person is shown in Fig. 1, and the greatly improved result with the new apparatus is seen in Fig 2. The body is laid on a platform on which are drawn the basic lines of the Bertillon system of measurement, and these lines are preserved in the photograph.

Former Way Bertillon Photo

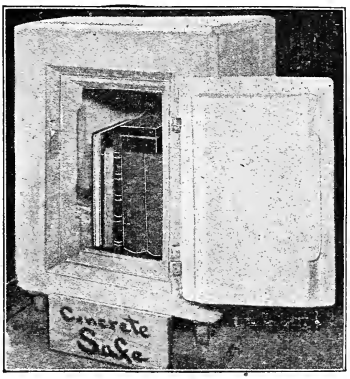
The camera is suspended directly over the subject, but other pictures are also made from the floor with another camera, giving a variety of positions. The chances of identification are very greatly increased by means of the new method.



The Vertical Camera

A CONCRETE SAFE

If concrete safes come into general use the owner will find it cheaper to build a new one than to move the old safe; and safes can be had in all sorts of inaccessible places by carrying a few small bags of sand and cement and building the safe from the materials. The concrete safe is not burglar proof, neither is the average steel safe, but it is sufficiently strong for all ordinary requirements against theft and fire.



The concrete safe illustrated was

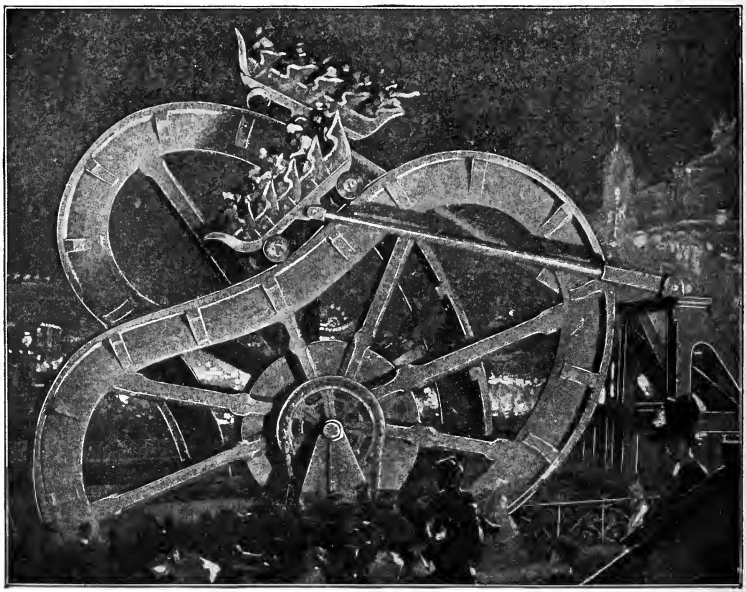
made in Seattle by a concrete building constructor. The Concrete Age says the safe is 2 ft. 4 in. square and 3 ft. high. Walls and doors are 4 in. thick, reinforced with ¼-in. twisted steel, with the lock and hinges, cast in the center of wall and door. The handle and castors were also cast in place. The construction is not specially difficult—anyone handy with tools can make one, and the iron parts can all be purchased and are comparatively inexpensive. A few dollars and a little interesting work will provide a good, durable, substantial safe.

NEW SENSATION COMING

The amusement loving public, which each year demand some new sensation, are likely to get it in plenty when the Avernus wheel, now building, is completed. It gives all the exhilarating features of the most reckless roller coaster but is much safer. The machine carries two wheels on the same axle, and on each wheel runs a car which can hold 20 people. The speed can be regulated, and the most wonderful varieties of motion can be obtained. The machine is an English invention.

ENFORCED BURIAL AT SEA

The enforced burial at sea of Mrs. Chalmers Prentice of Chicago by an Italian Commissioner aboard the "Koenigin Luise" of the North German Lloyd Steamship Company on April 27 has resulted in a suit for $250,000 damages against the company, who have taken the matter up with the Italian government in the hope of preventing future occurrences of the kind. Mrs. Prentice had been traveling first-class and every necessity for embalming the body was at the disposal of the ship's physician, but no appeal availed against the Italian's arbitrary decree.



You Hold Fast While the Car Plunges Like a Wild Broncho

TRAVELING BLACKSMITH SHOP

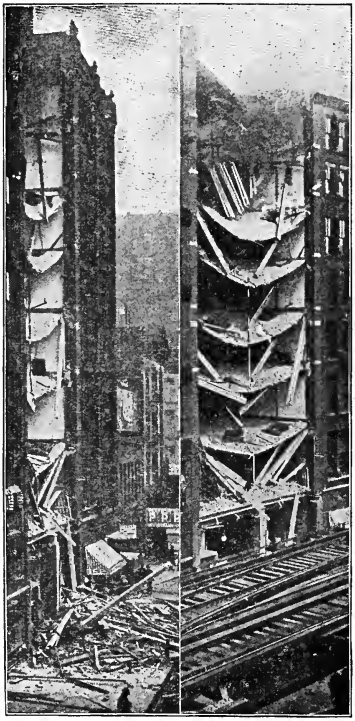
The Minneapolis fire department possesses a valuable adjunct which has received the tribute of imitation by other cities. It is a device for saving time and money by bringing the blacksmith to the horse instead of the horse to the blacksmith. As the department has 180 horses, each of which should be available at a moment's notice, day and night, the importance of such saving is obvious. There is a further economy in having the shoeing done by city employes instead of by outside smiths. The device is a wagon built and designed under the supervision of Chief Engineer Canterbury, which is fitted up with all the tools and apparatus for horseshoeing, including forge, rotary blower, anvil and vise. The two side springs seen in the cut, under the front platform, have five leaves and are 40 in. long, the cross spring has six leaves and is 38 in. long. The front wheels are 36 in., and the rear 48 in. In order

The Blacksmith Comes to the Fire Department Horse

that there may be no possible crippling of the service while a horse is being shod, the horse which draws the blacksmith wagon is put temporarily in the place of the one which is trying on his new shoes.

FRONT OF 8-STORY BUILDING FALLS OUT

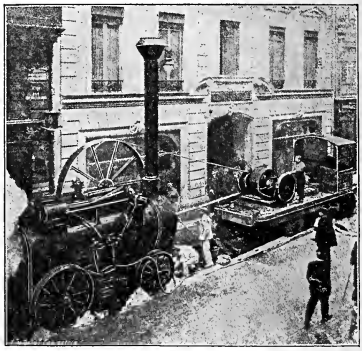
A very unusual accident occurred to an 8-story brick business building on Wabash Ave., Chicago. The building had been remodeled and filled with goods by a furniture concern. About 3 a. m. the entire front fell out, blocking traffic on surface and elevated roads for several hours. The only persons in danger were two cabmen who heard the building crack and drove out of the way just in time to escape death.



"The Entire Front Fell Out"

PARIS PRINTS PAPERS WITH AUTOMOBILES

Electric power is used to a very large extent in Paris, the newspapers depending almost entirely on it to operate their typesetting machines and presses. When the recent strike in the power houses occurred there was not only darkness in the cafés, where candles stuck in wine bottles were improvised for lights, but the daily papers came to a sudden stop. The resourceful French mind, however, instantly conceived the best thing to do, and automobiles of large horsepower were at once secured and used to furnish power for driving temporary generators placed on the sidewalk or in the street. In one case a motor car was actually carried up into a composing room and used to run the typesetting machines by belt drive. Traction engines were also employed; one of these is shown in front of the daily Journal, driving a generator which rests on a motor truck.



Traction Engine Furnishing Power

A Wisconsin farmer boasts a mahogany sidewalk, built from barrels in which he received goods shipped from the West Indies.

TREATMENT INSTEAD OF DRUGS

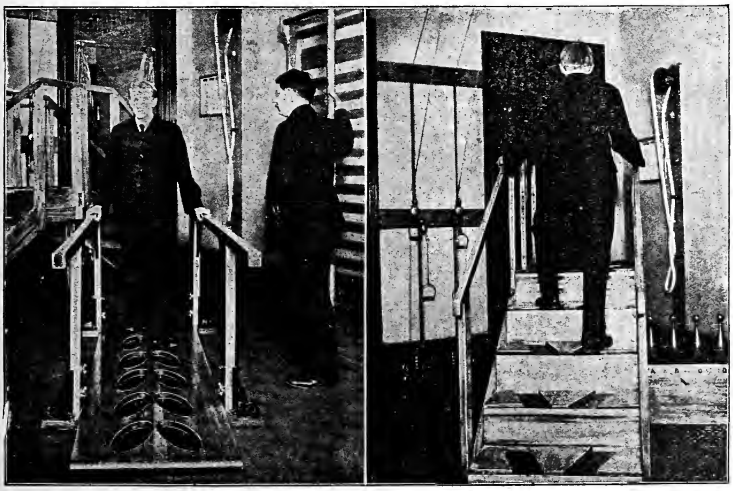
Patients Climb Stairs and Kick Indian Clubs

In many cases of nervous trouble the patients are now given mechanical exercises instead of drugs. One piece of apparatus is a stairway on which have been cut grooves for the feet of the individual who is condemned by fate and the physicians to tread the steps of this treadmill. This stairway, intended to bring back to those afflicted with locomotor ataxia the lost co-ordination of motion, has steps of a uniform height in each of which are cut-outs for the feet of the patient. As he walks up and down this odd stairway he supports himself by the handrails. He is compelled to place his feet in the cut-outs as he exercises and in time, it is claimed, regains the power of making his feet do as his mind dictates, instead of the pedal extremities wandering wildly off on excursions of their own. A variation of the same idea is the walking board, 20 ft. long, with handrails like the gang plank of a steamer.

Kicking the Clubs

This is for patients who lack the strength to mount the stairs.

A device that is still more curious is a ten-pin arrangement consisting of a block of wood on which are mounted on springs a number of pins similar to

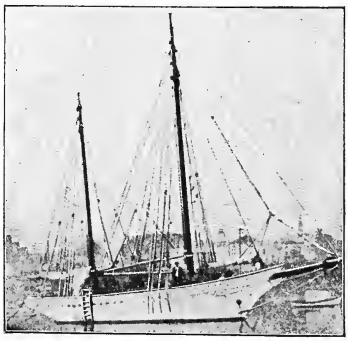


Walk and Stairs with Foot-Holes

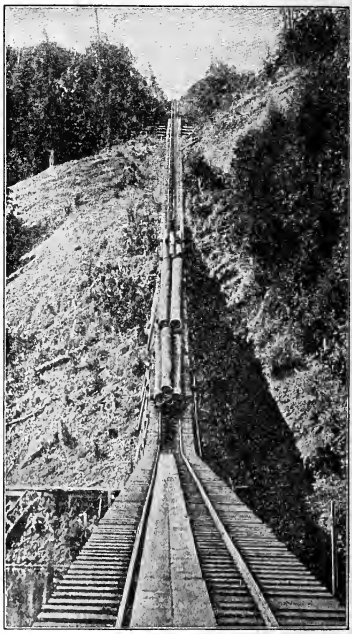
those used in our bowling alleys. Each pin is lettered or numbered and the patient sits in front of this apparatus and, upon the order of the nurse or attendant, kicks a certain pin either with the right or left foot, as ordered. The tendency of the erratic limbs is to attack the G pin when ordered to punish that marked A, or to inflict a jolt on B when it is the turn of the D pin to be kicked. Also the left leg refuses to obey orders and the right insists on taking up the kicking out of its turn, while the left will try to kick when it is right's inning. In time, however, according to the originators of this method of restoring lost co-ordination, the telegraph apparatus from the brain gets into working order again and the feet have to obey the will of their owner.

SEVEN YEARS' CRUISE IN SMALL BOAT

Jack London, the California author, is about to devote seven years to looking for trouble. He calls it adventure, and has invested $25,000 in a 57-ft. boat and outfit for himself and wife, a navigator and three sailors, with whom he proposes to sail the Seven Seas for seven years. As he is under contract to several publishers to furnish "copy" as he sails, we shall hear all about the voyage in due time if the boat keeps right side up.



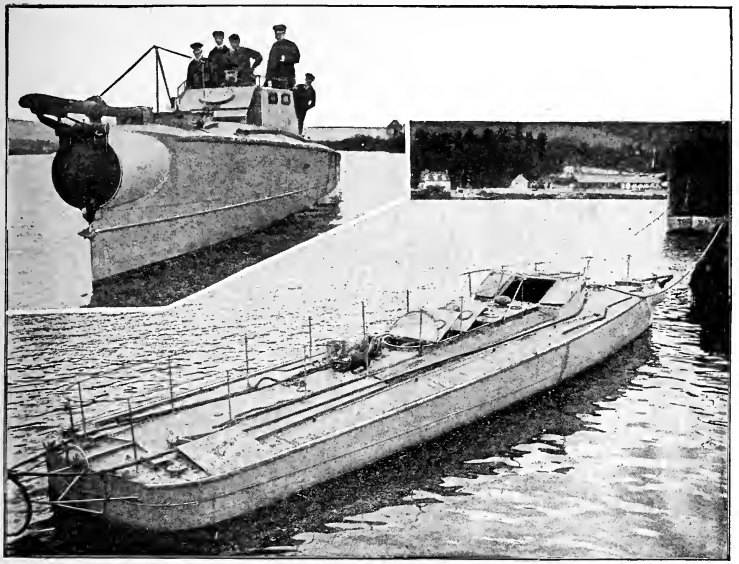
The "Snark" is 57 Ft. Long



A log railway over the mountains operated by a steel cable and winding drum.

His yacht, the "Snark," is only 57 ft. over all, 15 ft. beam and 7 ft. draft. The boat was built to order for this special purpose and is equipped with every foreseeable convenience and necessity, including three water-tight compartments. In case they are becalmed it is necessary only to start up the 75-hp. engine, which can be fed from a tank of 1,000 gal. of gasoline. Then there is a small arsenal of shotguns, rifles, revolvers and one rapid-fire gun.

To remove paint from clothing or hands, turpentine will be promptly effective, if the paint is fresh. If it is dried, the removal will be more difficult. Soaking in strong ammonia water, or in a 2 to 1 mixture of ammonia and turpentine, may do it.



Torpedo Boat—50 Ft. Long

POWER FROM THE BAY OF FUNDY

Since the maximum tide from the Bay of Fundy is 60 ft. high, it is not strange that a company has been formed for the purpose of utilizing this tremendous power. One of the farthest points to which the tide rushes is Chignecto Bay, and at the northeast end of that bay is the outlet of the Lautramar River, and the town of Sackville. There it is planned to construct three huge dams of concrete 60 ft. high and 1,000 ft. long. Turbines will be turned by the head of water thus obtained, estimated to generate 75,000 hp. If all goes well, next winter the famous Fundy tides will be operating all kinds of public and private utilities in Sackville, Amherst, Moncton, and other towns around the head of the bay.

In France and Germany a new paper cloth is said to be manufactured at one-third the cost of cotton.

LATEST FRENCH TORPEDO BOAT

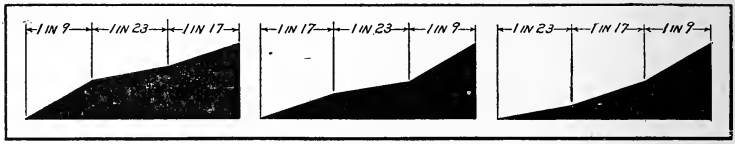
The French Government has just adopted a new model of motor torpedo boat, employing gasoline as fuel, which is sure to create a great sensation in naval circles.

This craft has been built after the plans of Comte Récopé, engineer of the French navy and a prominent member of the Auto Club de France. She is 50 ft. long and built of steel of sufficient strength to remain at sea in the heaviest seas. She can carry and eject a torpedo of 992.07 lb., charged with 220.46 lb. of explosive, when traveling at a speed of 16 knots an hour. The motor consists of eight cylinders, built tandem fashion, and developing 150 hp. This new craft will be attached to the port of Cherbourg.

The shipyards of Great Britain, all working together, could turn out a big steamship every day of the year.

MEASURING GRADIENTS

The length, height and steepest grade are not the only elements to be considered in determining the difficulties in hill-climbing with automobile or motorcycle. For instance, take three hills which happen to be compounded of different lengths of the same gradients in different order, say 1 in 9, 1 in 17, and 1 in 23, and most interesting results are obtained: one is easy, one is difficult, and the other a bad gradient. The explanation of this is simple, says a correspondent of The Motor, London, for on approaching the first example, the 1 in 9 grade is overcome by velocity, speed is again recovered on the 1 in 23, and the 1 in 17 is passed over without a change. The second diagram shows the same gradients transposed, and here again velocity is maintained up to the 1 in 23, when the 1 in 9 pulls down the momentum, necessitating changing gear near the top. In the third diagram there is no relieving of the strain, and the steadily adverse gradient pulls down the momentum, till the last part is a hopeless struggle.

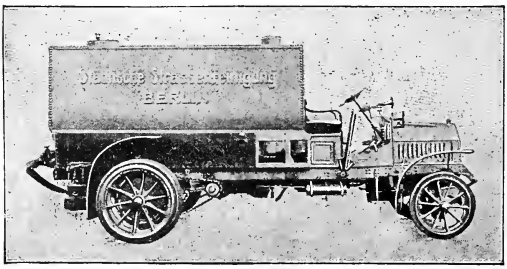


Fair Hill Stiff Hill Bad Hill

It is this disturbing factor that makes the grading of the roads such an intricate problem, for to say that the hill is 1 in 9 in each instance is to present only a partial view of the case. What is wanted more than anything is what might be called an average steepness to the hill in keeping with its speed-retarding possibilities. After all, this is the real value of gradients to the motorist or cyclist, and I am afraid that until all roads are engineered like railway lines with an unvarying slope, the matter must remain as at present.

Only 5% of the total cargo of the American steamer "Dakota" has been saved, including 11,771 sacks of wheat and flour and 477 bales of cotton. The ship struck a reef near Yokohama March 3.

UNIQUE AUTOMOBILE SPRINKLER



Sprinkler Holds 1000 Gal.

The streets of Berlin are being sprinkled with motor sprinklers, each of which does the work of five horse-drawn carts. The water is forced through the sprinklers at a uniform pressure by means of an air compressor which uses 3 hp. of the 18-hp. motor. The delivery of the water is controlled by four foot pedals. Most of the load is carried on the rear wheels, which have double rubber tires. The success of the motor sprinkler has been so pronounced they are being adopted in other European cities.

REPAIRING BROKEN FLOWERS

Machine for Correcting Nature's Mistakes

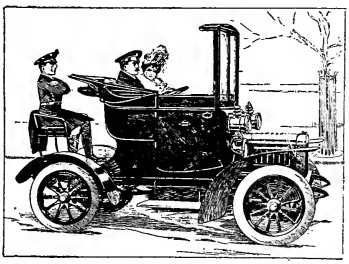
As Picked

Courtesy Weekly Florists' Review

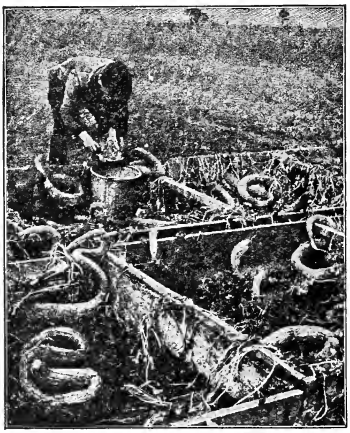
After Mended

The introduction of mechanical ideas in the greenhouse has resulted in great economies of labor and expense. The most unique scheme is the bright invention of a Pennsylvania florist, which will save thousands of dollars yearly to the shippers and dealers in flowers.

The demand for carnations goes on increasing year after year; frequently it is impossible to fill the orders. The purchaser insists on perfect blooms, but the carnation has a perverse habit of producing a large proportion of malformed blooms which are known to the trade as "splits." If the petals which hang down as shown in the picture at the left could be brought into symmetrical shape the flower would be salable. The inventor mentioned has succeeded in curing this defect and so skillfully is it done it is almost impossible to discover which are the repaired flowers. An instrument much like a pincers and a clip made of wire almost as fine as a hair rapidly and securely bring the petals into place and hold them there. The wire is almost invisible, and the flower has all the good looks and lasting qualities of any other carnation.



HOW FAR SHALL WE GO?—A writer having protested vigorously against the moustached chauffeur, one wonders how far horse equipage customs are to be followed. Shall we retain the "Tiger"?—Motor, London.



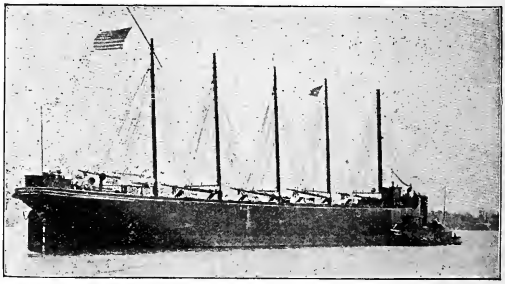
RAISING SERPENT CUCUMBERS

This curious vegetable is raised in frames and requires considerable skill. When the fruit is ready to gather the effect is that of numerous snakes. The serpent cucumber is grown in certain warm, sheltered districts of France and is gathered in August.

BARGE TO CROSS OCEAN

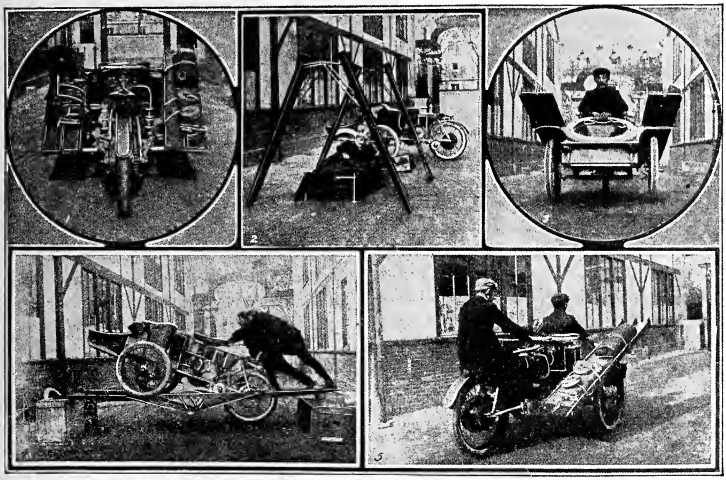
The Standard Oil Co. is to try the experiment of towing oil barges across the Atlantic. One of the barges is now being loaded with oil at Point Breeze, Philadelphia, and as soon as the cargo is aboard the barge will be taken in tow by a steamer, which will also be loaded with oil and towed to London. Both vessels will be deeply laden, having together 4,000,000 gal. of refined petroleum in bulk. It is expected that the run will be made in two weeks after leaving the Delaware breakwater. The trip is largely experimental for the purpose of ascertaining whether or not the towing of barges in the Transatlantic trade is feasible. The barge that will be towed across is shown in the accompanying photograph, taken while she was lying in the Delaware preparatory to loading.

ELECTRIC LIGHT IN EGYPTIAN TOMB.—The tombs of the Egyptian kings of Thebes, near Luxor, 450 miles from Cairo, are lighted by electricity, says Detroit News-Tribune. The sarcophagus shown above contains the mummified remains of Amenophis II., of the eighteenth dynasty.



Barge Ready to Load

A youth in Washington, D. C., has been sending out wireless messages from a private station, which confuse the official messages.



Courtesy Illus. London News

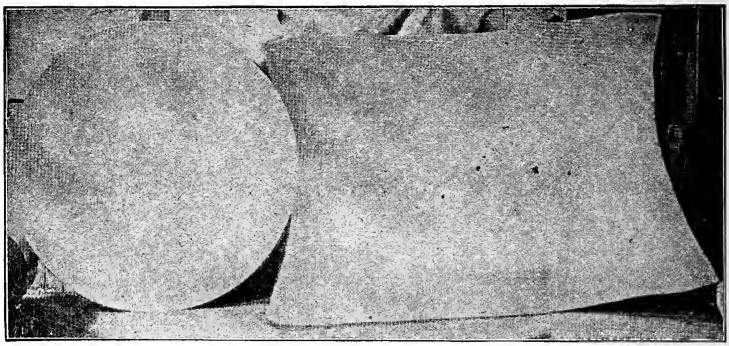
The greatest long distance motor race yet undertaken started from Peking, China, on June 10th. The course lies through Mongolia, Siberia, Russia and Germany, to Paris, the destination. There were numerous entries. Some of the contestants have resorted to very original devices to help them on their way. One of these, a portable bridge, is seen in the illustrations. By means of this the riders expect to get their heavy three-wheeled motor over ditches and small streams. The illustrations are:
1. The portable bridge fitted to the car. 2. How the motorists will pitch their tent for the night. 3. The bridge packed on the car for transit. 4. The portable bridge in use; pushing the motor across. 5. Another view of the bridge packed on the car.

MANUFACTURE OF ROLLED STERLING SILVER

The last quarter century has witnessed a revolution in the manufacture of sterling silverware which has brought it within the reach of almost every one. This change has not been caused by the cheapening of silver, but by improved processes for producing rolled sheet silver and of machinery for stamping all kinds of articles from the sheet metal.

The old method was to use silver rods, which were sawed, hammered and filed by silversmiths into the required forms. This slow and expensive method is still used in Great Britain, but not in the United States, except in some special cases where it would not be worth while to make the dies. But the manufacture of silverware is quite distinct from that of sheet silver. The latter is such a long and expert process, requiring much special apparatus, that most makers of silverware prefer to buy their silver sheets, just as in the brass trade.

The process of making sterling sheet silver may be summarized as follows: The first step is to buy pure silver "bars," which are really oblong blocks, usually containing 500 oz., the most convenient weight. These are 999 parts fine, which is as fine as any, even from the U. S. mint. The next step is to alloy the silver with pure copper, the laws of several states having prescribed that sterling silver shall be not less than 925 parts pure in 1000. In order to facilitate the weighing of the alloy, pure copper shot are poured first into the bottom of the melting pot until the necessary weight is obtained, and above these is placed the pure silver because its melting point is lower. The whole is then well covered with charcoal, to prevent oxidation of the copper. Five parts of cadmium are often substituted for 5 parts of the copper, to improve the malleability.



Largest Sheets of Silver Ever Rolled

During the melting the two metals must be thoroughly mixed by careful stirring. It is a matter of great experience and judgment to determine the exact moment for pouring out the melted metals; if they are too cold or too hot the casting will contain fatal imperfections. The casting is "sterling silver" and is 10 by 12 by $1\frac{1}{4}$ in.

Next comes a long series of cold rollings, interspersed with baths of sulphuric acid and chiselings to remove all impurities. In cutting them out it is necessary to leave a dish-shaped depression, otherwise the next rolling would cause the hole to fold upon itself, making a new defect. At last the sterling silver comes out of all its troubles a beautiful sheet of dead white, fit to be stamped into tableware for a king.

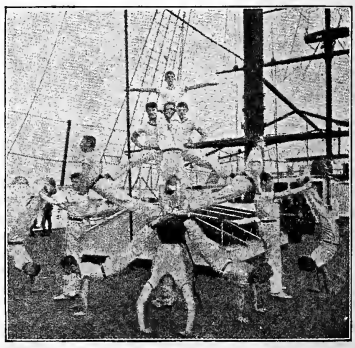
The illustration from the Brass World shows the largest sheets of silver ever rolled. The circle was cut from a sheet like the one at the right, and weighs 1,848 oz., and is worth over $1,200. Four of these circles were made, each 54 in. in diameter. They are being used in making seamless kettles for a special chemical process.

MILKSTONE SUBSTITUTE FOR IVORY

Skimmed milk in combination with formalin makes "galalith," or milkstone. It is good for manufacturing almost anything which is to look like ivory without chipping, cracking, or burning and which must be tough and take tints finely. The list is long, including billiard balls, piano keys, umbrella handles, doll heads, cigar holders, pen holders and knives, door knobs and picture frames. In Austria 100,000 people are kept busy in supplying the world with skimmed milk in artistic and practical forms.

CADETS GIVE GYMNASTIC DISPLAY

Once each year the naval cadets of the English training ship "Worcester" hold a prize contest to which the public is invited. The illustration, from the Shipping World, shows one of the set pieces requiring 15 men.



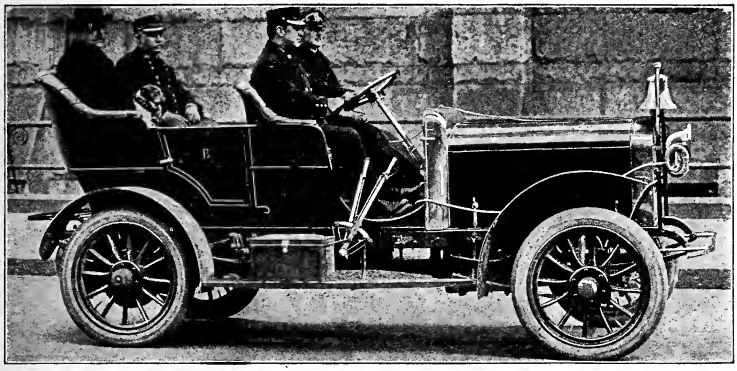
CHURCH ON GIANT VOLCANO

The most high church Episcopalians in the world are those who worship 4,000 ft. above the sea on the slope of a volcano on the island of Maui, Sandwich Islands. They are also nearest the mouth of the pit, for one of the largest craters on earth is but a short distance above the church. Regular services are held and are attended by many persons, and there is a church debt, which is more excusable than most church debts, in view of the difficulties to be overcome in building in such a location.

BOSTON'S FIRE CHIEF'S AUTO

The chief of the Boston fire department has turned his horse and buggy over to one of the captains and now goes to fires in the serviceable motor car illustrated. Its general utility was never dreamed of when the car was ordered, as shown in the record of the first two hours of the first day.

A rapid run was made to a fire in an outlying district, where several firemen were overcome by smoke. The men were placed in the car and rushed several miles to a hospital for emergency treatment. Returning to headquarters from the hospital a man was picked up who had just been injured by a runaway cab, then the runaway horse was chased and caught. Leaving an attendant in charge of the horse the car made another run to the hospital.



The Boston Fire Chief's Machine

TEMPERATURE IN STORAGE BINS

Large quantities of stored material, as coal, grain, oil, vegetable or animal fibre, often become heated at the bottom or center of the pile, while the surface remains cool. Spontaneous combustion frequently results. A thermometer has now been constructed which will show in an instant the exact temperature in bins or piles by switching it on to a wire which terminates at the center or bottom of the bin. Where this system is installed readings of the temperature of all the filled bins are taken at regular intervals and recorded in a book for future reference purposes.

NOBODY'S RAILROAD

Railroads are stolen often enough, but seldom lost or strayed; an Irish road has succeeded in accomplishing all three. It was 12 miles long and plastered with mortgages. As it proved unprofitable, neither builders nor mortgagors cared to work it, still less did any one care to pay taxes on it; consequently the assessors could not find any one who would confess ownership.

The people along the right of way rose to the emergency with enthusiasm, settling the question of ownership by carrying off gradually everything which was worth anything, except the roadbed. They had even brought up a crane to take away the bridge when the police put an end to that final transfer of ownership.

MINE RESCUE SCHOOL

The frightful loss of life in the mines of this country during the last few years has aroused the Geological Survey to devise preventive measures. These fall naturally under two heads: the prevention of deadly explosions in mines and the early rescue of miners after an explosion has occurred. Under the first head come the testing of safety lamps, and of the effects of different blasting explosives on the gases of mines. Those which are found safest will be urged upon the attention of mine owners.

For the study of explosives a cylinder of heavy boiler plate will be used, 100 ft. long and 6 ft. in diameter, lying upon the ground. This will be filled with an explosive mixture of fire damp and air, and then various explosives will be shot into it from a mortar and the effects noted. In other experiments the cylinder will be filled with coal dust and air.

For the study of rescue work a building will be fitted up in imitation of a mine to the last detail. After this imitation mine has been filled with smoke men will be instructed how to enter and search for bodies, carrying with them an apparatus for artificial respiration. It is probable that this experiment station will be located near Pittsburg.

A LESSON IN HOUSE LIGHTING

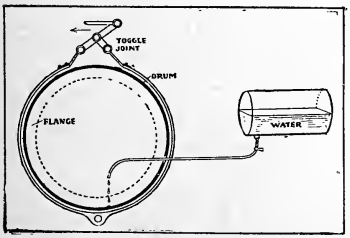
Light fixtures are too often placed without proper consideration of what the results will be. The Illuminating Engineer gives an excellent object lesson in the above illustrations which show the advantage of a properly placed side bracket, and the difference of working while standing so as to cast a shadow on one's work.

20,000 TRAIN SPEED INDICATORS IN EUROPE

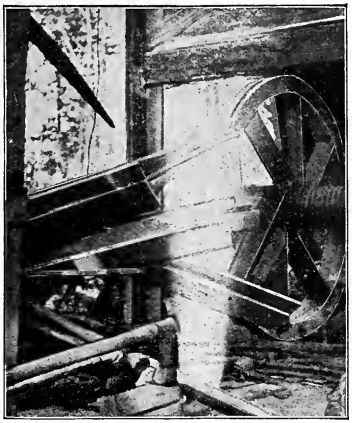
It is the law in France that every passenger engine must be equipped with a speed indicator, and similar laws will be enacted soon in Holland and Belgium. Their use is customary throughout the Continent, and in some of the countries even main-line freight engines are so equipped, since the indicators are considered quite as important as steam gauges and automatic brakes. In England, on the contrary, they are almost unused, and it is argued that the frightful accidents which have occurred there recently because of speeding faster than the regulations permitted would have been prevented by the use of speed indicators. The indicator not only shows constantly the speed, but records it in a locked compartment to which the engineer has no access. The trip record is taken to the office when an engine completes each run.

CONVENIENT WATER-COOLED AUTO BRAKE

Usually heating of the automobile brake is not sufficient to be serious, but in mountain touring involving long and steep descents some cooling device is often needed. One good method used is a small tank of water attached to a drip-pipe, from which the water drops upon the interior of the drum, says Motor, London. The latter is flanged to keep the moisture in, and water circulates also through the shoes, which are made hollow.



Water for Auto Brake



THE WORLD'S GREATEST GAS WELL

Drilled entirely by two brothers near the beautiful village of Kane, Pa., to a depth of 1,886 ft., considerably more than a quarter of a mile, is the world's greatest gas well, the only leak from earth's vast natural fuel works, it is said, from which the gas ever poured in such volume that it could be photographed. The accompanying illustration shows how for 50 days the stream of gas shot up like steam escaping from a safety valve on a high-pressure boiler.

For many long, weary days the two brothers worked their drill through the side of the mountain and finally, on September 22, 1906, penetrated the sand-rock and struck what is believed to be the largest gas pocket ever found. With a roar that could be heard 10 miles the liberated gas threw the tools out of the well and blew off the top of the derrick.

Then came a struggle with one of Nature's mightiest powers, but man conquered in the end and, on November 10, the giant well was capped. It is estimated that 100,000,000 cu. ft. of gas escaped at a pressure of about 1,500 lb. to the square inch, worth at the present price of the commodity about $6,000, for natural gas now is bringing

a higher price than it did in the height of the boom some 20 years ago, when it was believed that the supply was inexhaustible and street lights, once ignited, were allowed to burn without interruption day and night because men were too reckless to conserve the supply.

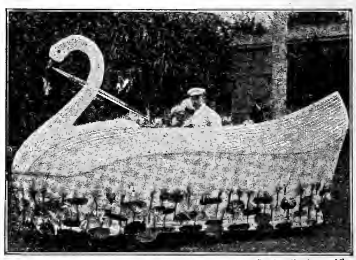
Of the world's supply of natural gas about 93 per cent is produced in the United States, Pennsylvania furnishing a large share. At the wells in that state it is sold for 6 cents a thousand cubic feet; commercial consumers get it for 16 cents, while for domestic use the price averages 25 cents. Although it was discovered in 1873, it was several years before use was made of it.

OFFICER STRUCK BY FLYING FISH

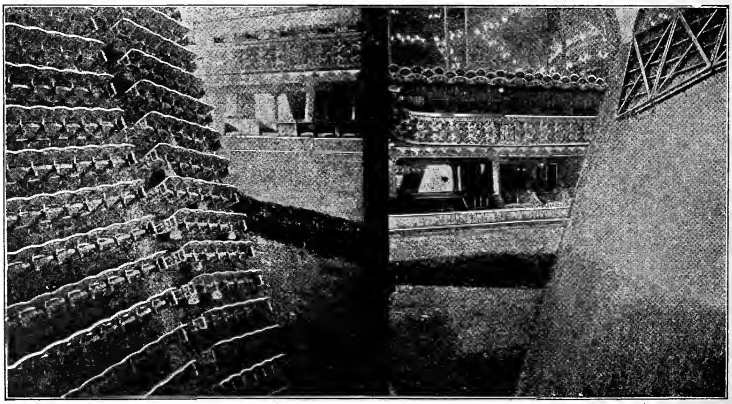
To the perils which beset those who do business in deep waters has been added a new one—flying fish. The first officer of the s. s. "Korea," just into San Francisco from Asia, was knocked senseless by a fish which struck him on the side of the head while the ship was between Yokohama and Honolulu. That this fish was exceptionally strong and ambitious is indicated by the fact that the officer was standing on the bridge at the time, 50 ft. above the water.

AN AUTO DUCK

The subject of this illustration formed an important part of the annual floral parade at Honolulu and took a prize. The motor being altogether out of sight, the whole affair glided along with a movement as mysterious as it was graceful. The spectators agreed that whatever else it might be, it certainly was "a bird."



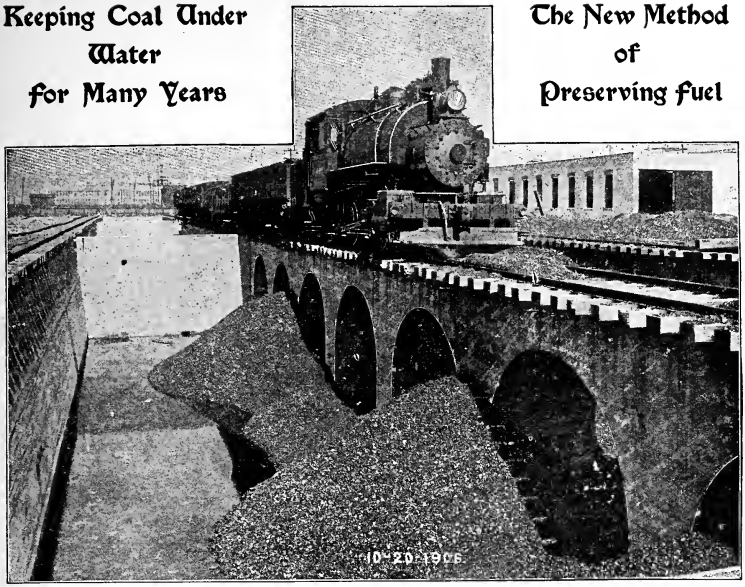
Courtesy the Automobile



The Theatre-Concert European, Paris, has a wonderful mechanical system, operated by electric motors, by means of which the floors turn completely upside down. In five minutes the floor can be reversed with the seats suspended below, and the upper surface an open dancing floor. So perfect is the balance that the revolution is accomplished with only a 1½-hp. motor.

Keeping Coal Under Water for Many Years

The New Method of Preserving Fuel



Filling the Concrete Tanks

The storage of vast quantities of coal is indispensable to the Navy and to large manufactories, especially in anticipation of scarcity through strikes or other causes. But coal exposed to the air for any length of time deteriorates seriously in calorific value, and experiments have been directed toward reducing this loss to a minimum. It varies according to circumstances, especially climate, and therefore cannot be stated very definitely, but it is estimated to range from a 12% loss in bituminous coal stored in England to a maximum of 40% at Hong Kong.

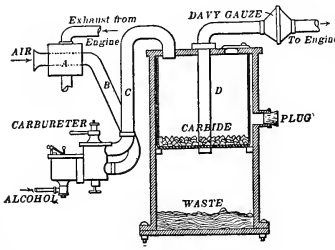
The best and simplest way to stop this oxygenization of coal seems to be by immersion, as tried by the British Admiralty at Portsmouth, Eng., and by the Western Electric Co. at Hawthorne, Ill. The latter has three large bins of concrete sunk in the earth, a total of 310 by 114 by 15 ft., and across them run four railway tracks on piers.

Piles Will Be Leveled; then Submerged

The cuts show more plainly than words how the storing is done. When coal is wanted they scoop it out with a steam shovel, and its being wet helps combustion and eliminates dust. Another advantage is that all danger of premature combustion, spontaneous or otherwise, is made impossible. The Western Electric floods the coal with fresh water, but English experiments with salt water are claimed to have increased the heating value.

ACETYLENE-ALCOHOL FOR GAS ENGINES

For years experimenters have puzzled over the problem of combining the advantages of both alcohol and acetylene gas into an ideal motor gas. At



last they have succeeded, and the new motive power is superior to gasoline in both efficiency and expense, thanks to the free denatured alcohol law which went into effect at the beginning of 1907.

Briefly stated, alkoethine is a mechanical combination of carbureted alcohol with calcium carbide. Experiments are still going on to perfect the process and determine all its features. One advantage observed is that the carbide extracts from the alcohol nearly all the contained water; also that there is a chemical reaction generating heat, which lowers the flashing point of the compound. Mr. P. C. Avery, of Milwaukee, Wis., has a two-cylinder autocar fitted up to use either gasoline or alkoethine by the turning of a few valves, which affords good practical tests of the comparative merits of the two gases. He dissolves 1 gal. alcohol in 8 gal. acetylene gas, and does away with any carburetor, injecting the combination into the cylinder by a slight pressure. The compound gas is kept in an ordinary gas tank with valve at top. The Acetylene Journal says:

"The defects of alcohol as a fuel have been that it works only with comparatively slow engines and that it is too slow in vaporizing to work effectively in high speed motors. Therefore no test of more than four hundred revolutions per minute has resulted satisfactorily. It requires very large quantities of alcohol, moreover, to obtain ordinary results and it will only work well when the cylinders are hot.

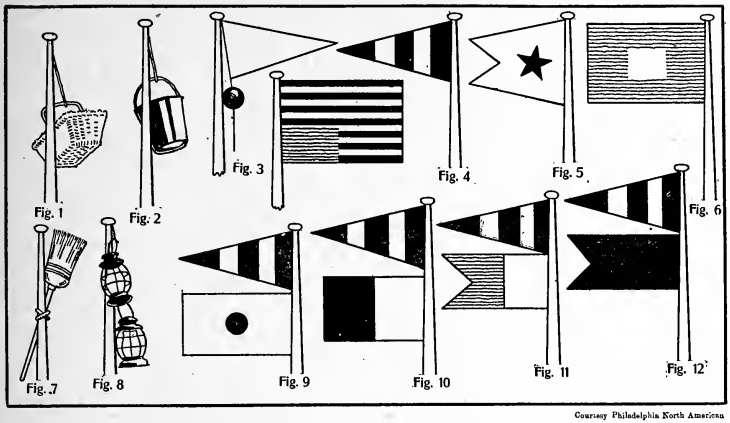
"Acetylene, on the other hand, owing to its high chemical purity, burns with rapidity and on this account has not lent itself with the greatest success to power combustion. The result of combining the two is that one offsets the other in a way that with denatured alcohol, low in price, makes it probable that gasoline as a fuel for motors and the like may find in the combination a strong rival."

Up to the present time the world's diamond production amounts to only about 20 tons. This would mean, however, 9,493,757 diamonds of one carat weight, each.

A DOUBLE COMFORTER

From England comes a novelty in creature comforts—a solid silver pocket flask with cigarettes on the side. As shown in the cut, a compartment opens with a hinge and closes with a snap, protecting the contents from crushing or moisture. Notice that the flask is curved flat, making it fit very snugly in the pocket. Price only $25, made in silver.

FLAG TALK OF OCEAN CRAFT



Courtesy Philadelphia North American

FIG. 1—Basket at masthead, "Cargo wanted." FIG. 2—Bucket at masthead, "Fresh water wanted." FIG. 3—Flag reversed or ball below pennant, distress signal. FIG. 4—Code pennant hoisted over every message; flag at masthead alone is answering signal. FIG. 5—House flag amidships tells ownership. FIG. 6—"About to sail; present your bills." FIG. 7—Broom at masthead marks maiden voyage. FIG. 8—Two lanterns on rearmost of tugs warns off tow following. FIG. 9—"I have not clean bill of health." FIG. 10—"I wish to speak to you." FIG. 11—"Get out of the way; I am on full speed." FIG. 12—"I am taking on explosives."

The flag language of the International Code Signals is spoken and understood in all parts of the world. Not a soul on one ship may understand a word of the language spoken by the men on another, but when either ship hoists a reversed flag the other instantly reads "Distress" and recognizes a call for help. This flag language provides for almost every contingency. In many ports, or sections of coast, the local trading boats have adopted the same system and have messages of their own. For instance a vessel approaching the fishing or oyster banks with a basket at its masthead is seeking a cargo.

Meeting steamers do not dread:
When you see three lights ahead
Port your helm and show your red.
For steamers passing you should try
To keep this maxim in your eye:
Green to green or red to red—
Perfect safety; go ahead.

The steel and electric manufacturing companies have orders amounting to $1,200,000,000.

MANUFACTURING MATCHES NOT SO DANGEROUS

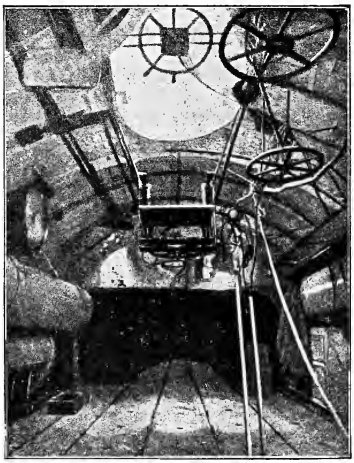
Modern methods have greatly lessened the dangers connected with the manufacture of matches, the entire process now being carried on without the touch of a human hand. Of old, as many as a hundred workmen a year in large factories would contract necrosis of the jaw by getting phosphorus into decayed teeth by inhalation or contact, the bones being actually consumed as by acid.

Now the teeth of the workman when he applies for employment are examined by one of the factory dentists, and unsound ones must be filled or drawn out. Also, the air in the factories is changed every four minutes.

Aluminum is hard to restore to its first beauty, especially the frosted finish. Immerse for a considerable time in water slightly acidulated with sulphuric acid.

23 MEN UNDER WATER 24 HOURS

That is the longest yet, 17 hours having been the top record for submergence until the test made in May with



Interior of Submarine

the "Octopus" and the "Lake." The first submarine carried 15 men, the other 8, and they went down in 30 ft. of water 7 miles from Newport, R. I. All the men had to do was to amuse themselves and be comfortable. They could read, sleep, eat, play cards, go fishing—anything but smoke. The fishing could be done out of the diving compartment door, and the meals, including one pie, were cooked on an electric stove. The news of the day was sent to them by telephone. The "Octopus" took down 70 cu. ft. of air compressed to 2,000 lb. to the sq. in; the "Lake" had 42 cu. ft. of compressed air aboard. Foul air was blown out through valves or through the door of the diving compartment, and this had to be done only twice for the "Octopus."

In every way the test was highly satisfactory. So little of the compressed air was used that both boats could have stayed down a day or two more. Samples of the breathed air were bottled every two hours on board the "Octopus," and will be analyzed.

HOW MANY HORSEPOWER EQUAL ONE TON OF ICE?

That is to say — how many horsepower must be expended to liquefy sufficient ammonia gas to produce the same amount of refrigeration as will result from the melting of a ton of ice? It is a difficult question to answer, for it involves not only careful experiment and computation, but also a number of variable factors. Furthermore, it is always necessary to allow a liberal margin between theoretical and practical efficiency, due to loss by superheating, clearance, etc.

Theoretically, for a condensing pressure of 103 lb. and an evaporating pressure of 4 lb. the horsepower required to liquefy gas enough to produce as much refrigeration as the melting of one ton of ice is 1.0584. For a condensing pressure of 218 lb. and an evaporating pressure of 51 lb., the horsepower is .7629. But in practice these estimates of horsepower must be increased 15 per cent to 20 per cent, according to size of compressor, for reasons stated.

AUTO ELECTRIC HORN

A "press-the-button" electric horn for automobiles is the latest thing in honk-honking. The horn is operated from a

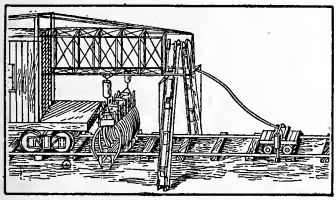
Makes New Kind of Noise

battery, and when the circuit is opened and closed a resilient diaphragm makes a new kind of noise.

TRACK TAMPING MACHINE

If you ever watched the construction gang who follow after the men who have spiked the rails to the ties, you saw them bring a straight, level, solid track out of a snakey, wavy, uneven, line of rails. It took a small army of men; and the work was all hand work, using levers and levels, track gauges, shovels, tampers, and crowbars. Your chief impression was: "What a lot of money it must cost."

It does cost money; one Canadian engineer who has built tracks for years says this part of the work alone on a 200-mile track costs $140,000. And so he has invented a machine which is claimed to do this work for $25 per mile, which would mean a saving of $135,000 on 200 miles. His machine is 60 ft. long and does its work with air compressed in the car. First the track is lifted to the required level and held there while elevators bring up earth from either side. Next a row of sharp pointed arms get busy on both sides and ends of a tie and push the ballast down. These arms move as fast as a section hand when the "old man's" special comes along, and is warranted not to stop to light pipes or wait for the water boy. Altogether it is a great thing—if it works.

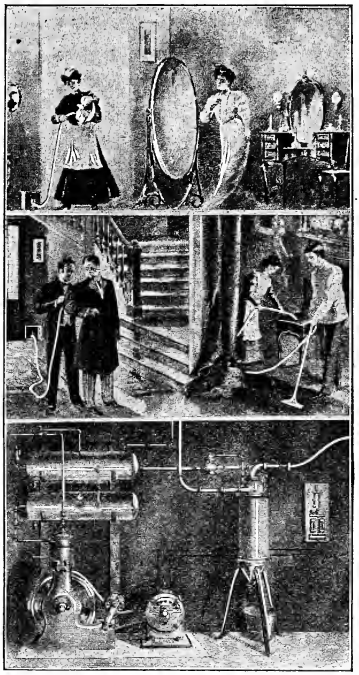


Compressed Air Tamping Machine

A large gyroscope located in the hold immediately ahead of the boilers in a German torpedo boat, and driven by a steam engine up to 3000 r. p. m., reduced the arc of rolling of the vessel from 30° with the gyroscope still, to 1½° with it in motion.

CONVENIENCE OF COMPRESSED AIR CLEANING

The uses of compressed air most familiar to the average citizen are those he sees when walking along the street,



Cleaning with Air

where some skyscraper is being riveted with pneumatic hammers, or a portable compressor is pumping dust from a residence or office building.

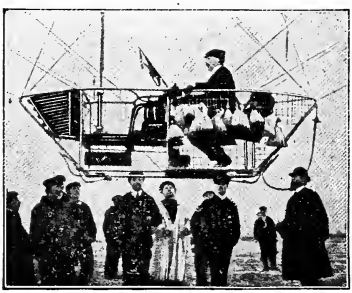
The air cleaning system which has revolutionized old methods has now been applied to residences, and small outfits occupying little space are now available as a permanent fixture in the home. The compressor can be operated with either a small gasoline engine or an electric motor, and concealed pipes extend to each floor or room. In addition to a daily or weekly removal of

dirt short hose connections are used for dusting wearing apparel as well as the house furniture. The apparatus is simple and requires no exertion in its use. All the dust is drawn to a receiver in the basement, from which it is removed as often as necessary, usually once a week. With compressed air an 8-year-old child can sweep and dust a house and do better and quicker work than several adults with brooms and dusters.

THE DANGERS OF FLYING

By L. J. Lesh

How often nowadays we hear remarks such as this: "He has succeeded in flying, has he? Well, let him fly; but you can excuse me when it comes to anything as dangerous as that." Yet the same person who swears that he would not ride a flying-machine for all



The Start

the money in the Bank of England does other things merely for sport that are fully as dangerous as flying (with the machines we now have at our command); things, too, that give him vastly less pleasure than he could get out of a strongly made and well tested aeroplane.

To the inexperienced aviation seems attended by dangers that loom up as almost too great to be braved by a human being, and the would-be flying man is accordingly quite surprised when he finds that, after a little practice, a flying-machine is almost as safely and easily handled as a bicycle. In fact, he finds that about the only difference between coasting downhill on a bicycle and sliding upon the air on a gliding machine is that in the latter it is necessary to instinctively adjust the fore and aft balance, which in the bicycle is always preserved as long as the two wheels touch the ground.

The first machine to carry a man through the air for any considerable distance was the Lilienthal soarer, which, however, possessed such poor fore and aft balance that it could not be safely operated in winds of over 20 miles an hour. It was this defect, coupled with its bad condition of repair, that probably caused the death of its operator.

Since Lilienthal's death earnest attempts have been made towards producing a machine that should be structurally strong and possess good equilibrium, even though less important features had to be omitted to make these conditions possible. These efforts have produced the Chanute and Wright types of aeroplane, which are satisfactorily strong and safe to handle, and yet are quite efficient in flying qualities.

The truss construction now used by nearly all aeronautical engineers provides such a strong and rigid framework for the aeroplane surfaces that breakage of this part of the machine seems practically impossible. The part of future dynamic aeroplanes that will undoubtedly cause the most trouble will be the motor, for as yet none has been developed that is even reasonably immune from breakage and stoppage. Of course, if the motor stopped a flier would have to come down, and if it happened to be flying over an undesirable landing place and did not possess the power of gliding flight it might come to grief when it lit.

The recent flights of the Wright brothers seem to indicate that they have found either a successful equilibrium preserving device or a vastly improved arrangement of steering surfaces, so that at last we can cease bothering

about the balance and control of a machine.

The Wright flyer is capable of being steered with even greater accuracy than an automobile or bicycle, and yet the operators have spent far less time in actual practice than is required to obtain a mastery over either of the last two conveyances.

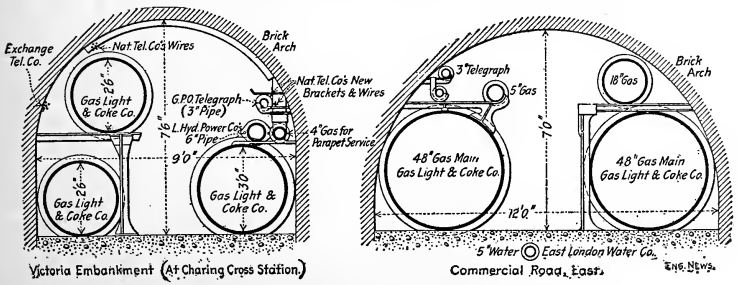
To a person who has had considerable experience in the air the possibility of accident seldom occurs, and indeed the motion is so rapid that there is no time to think about it during a flight. People seldom think of the risks they run while riding at 100 miles an hour in a railway car, or half a mile a minute in an automobile, and it is quite probable that after the novelty of the thing wears off there will be few people afraid to experience the quick rush of the aeroplane.

Manchester Subway

SUBWAYS FOR CITY PIPES AND WIRES

European cities are making great headway in the construction of subways beneath the streets to contain not only electric wires for light, power and communication, but also for the gas and water pipes. In London a subway for these utilities is now built whenever a new street is authorized. Some of the London subways are as large as 7 ft. high by 12 ft. wide; there are already seven miles of these pipe subways.

In Manchester the subway has now reached a length of 7,386 ft. and is used exclusively for electric wires, which are contained in pipes carried on iron brackets fastened to the walls. The cost was $39 per linear foot. Other cities where the system has been built are Leeds, Nottingham and St. Helens. The construction is paid for by the city, which charges an annual rental from the service companies, which more than pays the interest on the cost. These annual charges are based on the diameter of the pipe, ranging from 60 cents for 3-in. diameter or less up to $12.50 for 36-in. per 300 ft. for water or gas. For other companies the rate is much higher, being $6.50 for 3-in. pipes and $20 for 18-in. per 300 ft. The freedom from leaks in water and gas mains, and the ease and economy with which repairs can be made make the

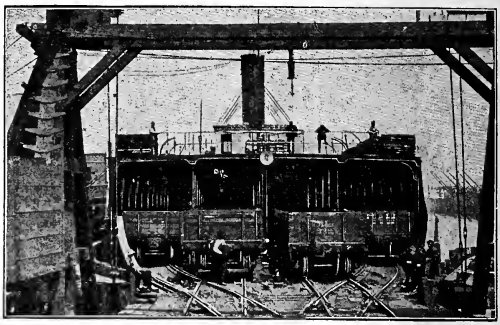


proposition an inviting one to the tenant companies.

Our American cities should take up the pipe subway question and not only provide a revenue producing power for all time to come, but save the everlasting tearing up of our streets.

LOADING A LAKE ERIE CAR FERRY

Crossing Lake Erie on routes of 50 to 60 miles, between the United States and Canada, ply several car ferries, each carrying from twenty-five to thirty cars. These ferries are open at the rear above the car deck and are equipped with tracks of the same gauge as those of a railroad. The method of loading is to back the ferry up to an apron, which is lowered and raised by means of weights to the level of the ferry tracks. This level, of course, varies with the stage of the water in the river. The tracks of the apron connect those of the dock with those of the ferry and thus admit of switching cars aboard as shown in the photograph. Once the cars are in their place on the ferry they are fastened securely for the trip. Coal is one of the chief commodities carried in this manner.

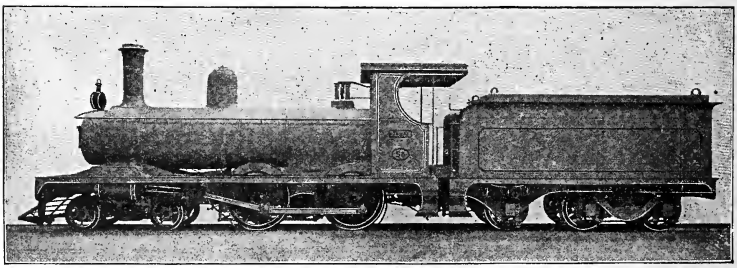


Car Ferry Open at the Rear

MINER SAVED BY DIVER

Thrilling Rescue in Australian Mine

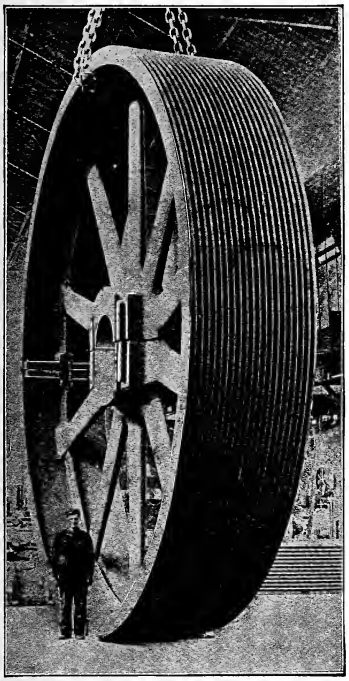
It was in a flooded mine in Western Australia that divers were first employed to do rescue work. All the miners had escaped except one, and they knew he was alive somewhere because he was knocking—any one would be a knocker under such circumstances. Divers were brought by special train from the coast, 400 miles away, and were sent in. One of them found the man 500 ft. from the shaft, and carried him food, clothing and candles while the water was being pumped out with feverish haste. But it took nine days to get it down to a 5-ft. depth, and when the imprisoned miner tried to wade out he fainted and was carried most of the way.



FOREIGN LOCOMOTIVES—The above is one of the English built engines used in the Soudan. It is of rather light construction, weighing about 32 tons. It is built on American lines to a considerable extent—in fact, several were built in the United States.

BIG ROPE DRIVE

The illustration shows one of the three sections which when put together formed a rope driving wheel 24 ft. in diameter and 14 ft. face. The single



24 Ft. in Diameter

section weighs 90,000 lb.; the assembled wheel 135 tons. It has been put in service in a steel mill driving the sixty 2-in. transmission ropes at a mile a minute.

SMOKELESS SOFT COAL

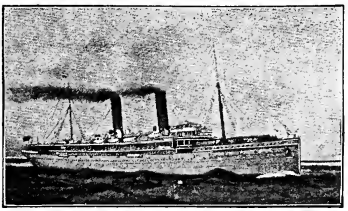
A report comes from Manchester, England, that a company has been formed and five acres purchased near that city for the purpose of erecting large works to exploit a new invention. This is declared to be no less than a process for depriving soft coal of its smoke by extracting the valuable oils which produce it. The residuum is called coalite, looking like coke, but much more bulky and heat-producing, and salable at one-third the price of coal. Of course, the by-products are expected to be very valuable.

STEEL CANAL IN SAHARA DESERT

On account of the desert sand storms, the porosity of the soil and the extreme dryness of the climate, it was found necessary to build a canal of steel instead of using stone or cement at Kom-Ombo, in upper Egypt. The canal conducts water for irrigating purposes, is 19 ft. 8 in. wide at the top, 21 ft. deep and 5,610 ft. long. It was constructed of sheet steel which was riveted on the ground, 650,000 rivets being used. As the thermometer stood at 117° in the shade at noon, the difficulty of working inside the steel shell can be imagined.

PORT OF NATAL IMPROVED

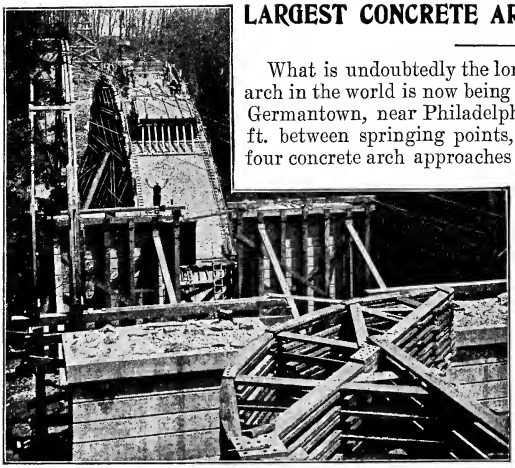
Prior to the entry of this steamship the mail steamers were unable to enter the Port of Natal owing to the shallow entrance to the harbor. Several months' dredging have resulted in 35 ft. of water, and now the weekly mail steamers load and discharge passengers and cargo at the wharf.—Contributed by A. Leach Wood, Durban, Port Natal, South Africa.



The First Steamer

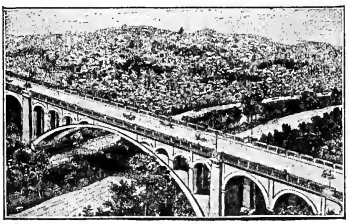
LARGEST CONCRETE ARCH IN THE WORLD

What is undoubtedly the longest single span concrete arch in the world is now being constructed in a bridge at Germantown, near Philadelphia. The main span is 233 ft. between springing points, and 60 ft. wide. With four concrete arch approaches the entire length is 520 ft., and will cost $256,000. The bridgeway will be 120 ft. above the creek, and will afford a driveway of 40 ft., with an 8½-ft. sidewalk on each side.



Framing for the Big Arch

The longest masonry bridge span is 295 ft. 3 in. long, at Plauen, Saxony; second comes the stone arch at Petrusses River, Luxemburg, 275 ft. 6 in.; and third the Cabin John bridge at Washington, 219 ft. 9 in. in length.

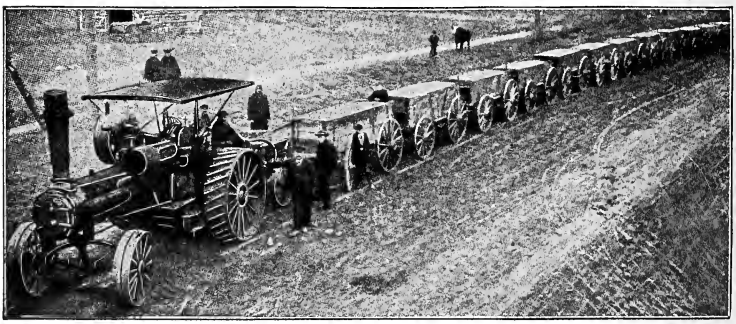


The Completed Bridge

LONG TRACTION TRAIN

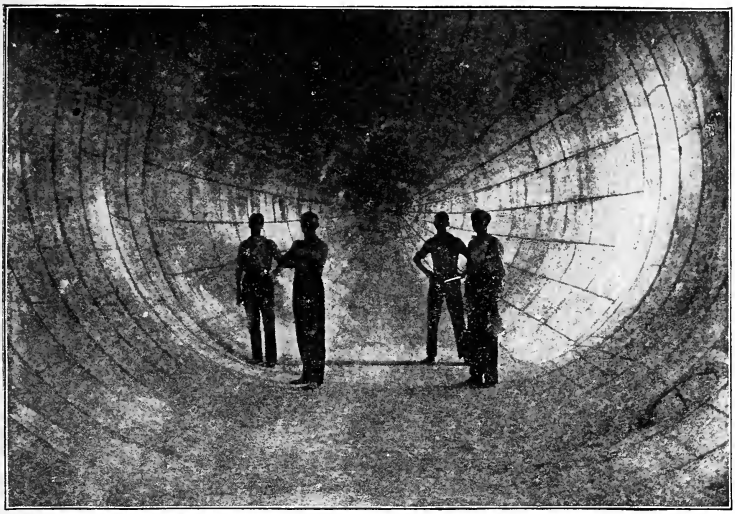
The traction engine is 20 hp. and drew the train of 14 loaded wagons eight miles on half a ton of coal. The outfit weighed 35 tons; the wagons contained 890 bu. of shelled corn, and the entire train was 180 ft. long.

This method of hauling requires only one man to a train.



The Train Was 180 Ft. Long

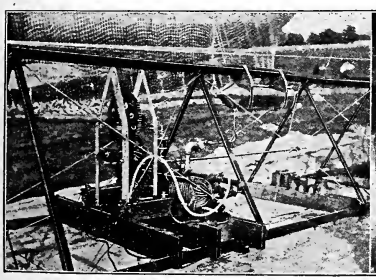
FINISHING THE GAS BAG OF AN AIRSHIP



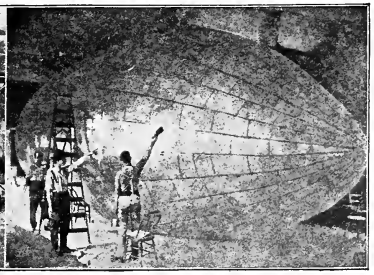
Interior of Gas Bag—Men Work in Stocking Feet

Finishing the interior of the big gas bag of an airship is one of the most delicate and important tasks in the entire construction. One of our illustrations shows the interior of the dirigible balloon built by W. H. Dilger of Cincinnati for entrance in the aerial navigation contests at the Jamestown Exposition. The bag is inflated with air and the men are working in their stocking feet in order not to injure the delicate silk fabric, and have been applying white soapstone, which is used to keep the tissue from sticking together, as the varnish never becomes quite dry, but is always a little tacky.

The segments of the envelope are clearly shown in the views. These segments are sewn together and the seams reinforced on the inside with strips of the material. This construction prevents the material tearing farther than



The Driving Machinery



Varnishing the Bag

the nearest seam, should the balloon burst, and gives the navigator a chance for his life, as the gas cannot escape as fast as it would from a large rent. The varnish used is specially prepared, every builder having his own secret formula, and is applied in thin coats, so the pores of one coat will not come opposite those of another.

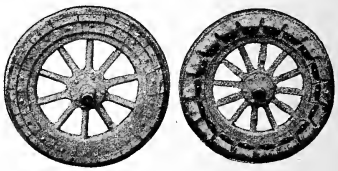
The engine in the frame supplies propelling power. It is of 12 hp. and weighs 80 lb. The hydrogen generator is a big tank of 3,200-gal. capacity and makes 700 cu. ft. per hour. Cotton twine net is used to fasten the car to the balloon. On a spherical bag it always has a diamond mesh, and on a dirigible a square mesh.

Mr. Dilger for several years conducted upper air explorations for the United States government, and also worked with M. Santos Dumont in Paris for two years. He will attempt to travel by airship to the Exposition.

"TURN DOWN" ELECTRIC LIGHT

The illustration shows the latest improvement in the way of an adjustable incandescent light. It fits on any ordinary wall socket, and by means of a small lever turns the light on or off in the same way a gas jet is controlled. The lamps heretofore have had only two degrees of light—half power or full light, but this burner can be set to give just the right amount desired.

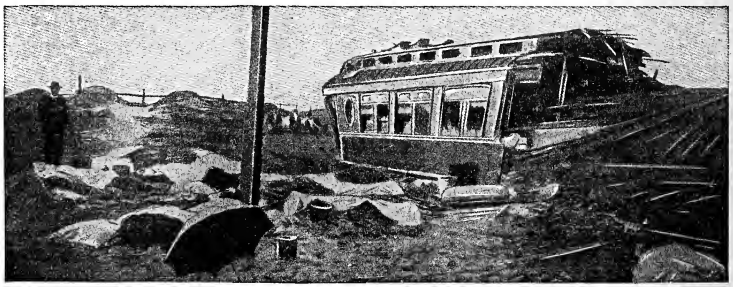
Bad air is bad for wood as well as for men. Seven weeks of it in a mine is said to have rotted 12-in. Oregon pine. Of course, some gas present in the mine had a chemical affinity for the wood.



SPRING AUTO WHEELS—The one at the left is the front wheel; the other the rear wheel. A French construction.

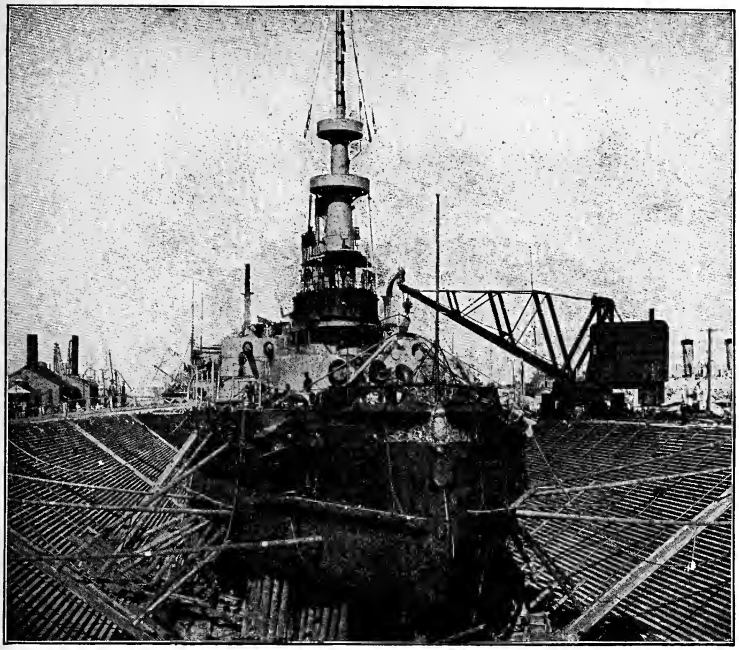
STEEL SLEEPING CARS

A nearly all-steel sleeping car is one of the mechanical exhibits at the Jamestown exposition. The car is 72 ft. long, 14 ft. high and 10 ft. wide, and metal is used wherever possible; the seat frames and upper berth are of pressed steel, while the rivets in the outside panels are countersunk, leaving a perfectly plain surface. The effect is to more closely resemble a wooden car than any steel cars heretofore built.



Courtesy Phila. North American

Pullman Car in California Wreck of Shriners' Train—The White Sheets Cover Bodies of the Dead



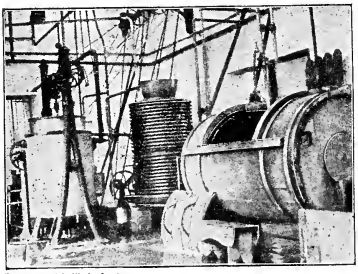
First-Class American Battleship in Dry Dock Showing Manner of Holding Ship in Place with Timbers of Great Strength

ANNUAL WATER SUPPLY OF LONDON

If all the inhabitants of the earth were gathered into one place, surrounded by a wall 10 ft. high, and the annual water supply of Greater London were poured in, the reservoir would be filled to overflowing. In other words, each man, woman and child in the world could be supplied with 50 gal. a year from the city mains, which, put end to end, would cover nearly ¼ of the earth's equator. Or, in other words, every person in London could take a 33-gal. bath daily, besides having plenty of water for drinking and other purposes. But that is just what they certainly do not do, so where does this flood of water go? Probably, as in other great cities, into breweries, slaughter houses, factories, hydraulic elevators and other industries, besides an enormous wastage. But it has to be paid for just the same—over 16 tons of gold a year is what it costs.

COTTON GROWING IN KOREA

Korea is likely to become something of a factor in the world's cotton market. The Japanese department of agriculture has raised an experimental crop of 100 bales from American seed with highly satisfactory results. The yield per acre is said to be almost incredible and is explained by the unusual amount of hand labor employed in raising the crop, the coolie labor being so very cheap. The Japanese spinners now import 200,000 bales of American cotton annually.



Courtesy World's Work, London

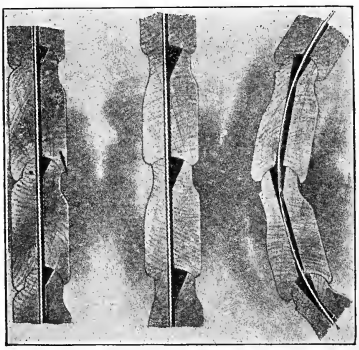
In Ireland mechanical methods are rapidly taking the place of hand work. The illustration shows a modern Irish creamery of which there are now several hundred.

BY AUTO TO SOUTH POLE

Next October a new Antarctic expedition will start from England. The ship will carry, in addition to the usual supplies for such an expedition, an automobile especially prepared for ice and snow traveling. Lieut. E. H. Shackleton, who has had Antarctic experience, will try for the South Pole with this substitute for dog sledges. It is a pretty bold venture, for the ship must return to New Zealand after landing him to avoid being frozen in.

WOODEN ROLLING DOOR

A patented door which rolls up like a curtain is now on the market and is desirable for use where room is not available for a solid sliding door. The wood seats are strung on phosphor bronze ribbons, and the edges slide in grooves at the sides of the doorway. The steel barrel on which the "door" is wound contains strong springs which counterbalance the weight of the curtain. A door 13 ft. wide and 17 ft. high can be opened or closed in thirty seconds.



Rolls up Like a Curtain

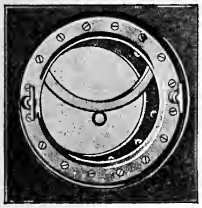
AERIAL NAVIGATION A SUCCESS, SAYS DR. BELL

"The problem of aerial navigation already is solved and America is in advance of the rest of the world in heavier-than-air flying machines." This was the emphatic statement made by Professor Alexander Graham Bell in England, recently, whither he had gone to receive the degree of doctor of science conferred upon him by Oxford. Dr. Bell declares that "there is left only the problem of improving the machine that has been invented" by the Wright brothers, and others, and that "great credit is due Mr. Octave Chanute of Chicago," who not only induced young Americans to experiment, but paid much of the expenses out of his own pocket. In regard to future developments, Dr. Bell said:

"The development of the airship, I think, will come for other than commercial reasons, for the flying machine is destined to take an important part in warfare. The war departments of different governments are watching with greatest interest whatever is being done in this direction, and once a successful airship is given to the world its growth toward perfection will be more rapid than anything ever seen.

"The airship will overturn all present methods of warfare. Then, too, wealthy men will take to airships as they have taken to automobiles, and the machines will be developed for speed. They will undoubtedly be utilized for purposes of rapid and light transportation, such as carrying the mails."

VENTILATING AIR PORT



Partly Open

A valuable addition to the comfort of sea travel is a new ventilating air port which can be left partly open even in rainy or stormy weather. The Marine Journal says: "The air-port sash is operated by raising or lowering, in a similar manner to a window in a house, and is easily operated as the weight is balanced."

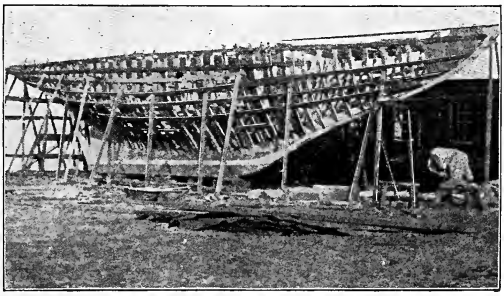
WOODPECKERS RUIN POLES

The Southern Pacific is about to build a new line, 250 miles long, in Old Mexico, which will require 7,000 telegraph poles. Now a nicely seasoned telegraph pole, deviled with juicy worms, is just nuts and raisins for a woodpecker, and the company has reason to fear that in a short time its 7,000 poles will be mostly holes. So the wise men of the Southern Pacific will try to spoil the woodpecker's appetite by steeping their poles in creosote.

HEAVY KEEL—ODD CRAFT

An odd craft is being built at San Diego for an Englishman from plans of his own design. The sailboat has a length over all of 68 ft., breadth 14½ ft., while the keel, which is made of one piece of lead, weighs 15 tons. The lead is the lower dark portion shown in the photograph, and measures 24 in. wide at the middle by 15 in. deep, and is 27 ft. long. It tapers from the middle to about 8 in. wide at bow and stern.

The lead keel was cast out of doors in the ground, the mould being made from a one-piece pattern. As no melting facilities were at hand for pouring 15 tons at one time, three pots were secured, each holding about 2 tons, and these were kept going 12 hours, and poured alternately. The keel is fastened with heavy bronze bolts.—Contributed by Leo G. Haase, Pasadena, Cal.



15 Tons of Lead for Keel

STEEL BOX CAR

Steel box cars will eventually replace the wooden ones just as the steel gondolas are displacing that type of freight

Capacity 50 Tons

car. The illustration shows an all-steel car built at the Omaha shops of the Union Pacific Railway. This car is 40 ft. long inside, has a center door 8 ft. wide, weighs 37,000 lb. and has a capacity of 50 tons.

PHOTOGRAPHING LIGHTNING

The season of thunder storms is at hand, and anyone with a camera will find the photographing of lightning both instructive and fascinating. Some excellent suggestions are made by Dr. Lockyer in the Photographic Journal, London. He divides ordinary lightning into four general classes: Stream, sinuous, ramified, and meandering.

Fig. 1—Zig-Zag

Fig. 2—Sinuous

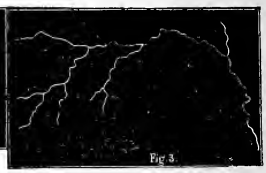


Fig. 3—Ramified

The photographing of lightning is a simple matter. The lens should be focused during the day upon a distant object, or at night on a distant lamp, and the baseboard marked if necessary, so that the lens can be set for infinity at a moment's notice when required. A dark night is best for the purpose, and, when the thunder clouds are seen to be gathering, the camera with the plate should be placed in position, being directed to the point where the flash is expected, the slide drawn, the lens uncapped, and the instrument allowed to remain until a flash has occurred.

A "Ribbon" Flash

Occasionally one flash will follow another and show double on the plate, producing a "ribbon" or "band" flash. This is caused by the second flash following the same heated column of air, after the wind has shifted the air column. Lightning may be photographed in the daytime by using an extremely deep yellow screen. The camera should not be moved during the flash; holding it in the hands will not yield perfect results; it must be rigid.

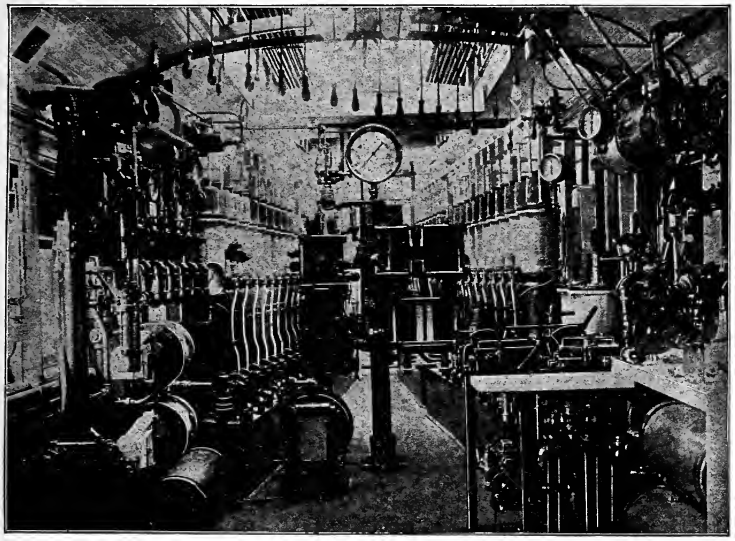
Thunder travels one mile in about four or five seconds; by counting the seconds between the flash and the report the distance can be fairly estimated. Some flashes descend from the cloud to the earth, and others ascend from earth to cloud. When both ends of the flash are included in the photograph it is a simple matter to trace the course. This method can only be used when the flashes are ramified. A ramified flash resembles a river with its tributaries, but the current travels in the reverse direction to the river flow; the lightning commences at the estuary end of the main trunk and breaks up into ramifications as it proceeds, so that when two images of a multiple flash are on the plate and the ramifications of one point towards the earth, and of the other towards the sky, it might be assumed that they traveled in opposite directions.

DIVORCE BY WIRE

The marriage tie is only a "granny" knot nowadays, as everyone knows, but a Los Angeles lawyer is the first to untie it at long distance. His client, a California woman, wished to enter a cross-complaint to her husband's action for divorce, instituted at Chicago, and the lawyer carried on the proceeding by telegraph, regardless of a bill that amounted to no small proportions.

RAILWAY SCHOOL ON WHEELS

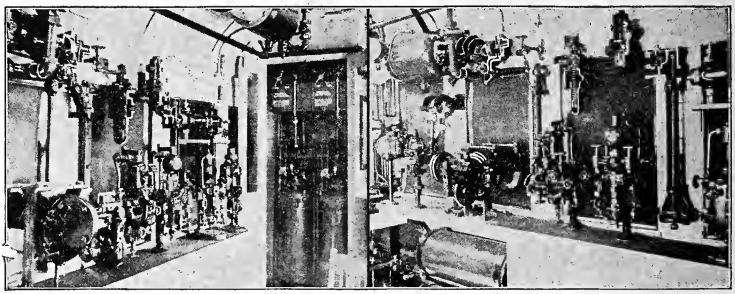
The increasing complexity of modern mechanism demands technical knowledge as well as intelligence and faithfulness on the part of employes, and employers are adopting various methods for supplying this need. One of the best of these is a school-car fitted up by the C., B. & Q. Ry. for the instruction of its trainmen in all the details of mechanism—and operation of



This Car Contains Brake Equipment of 47 Cars

the New York and Westinghouse brake systems, of electric and acetylene train lighting, and of air signal apparatus. All this is so skillfully packed into one car as to give an accurate idea of the equipment for a train of fourteen 60-ft. cars, and yet everything is in plain sight of each member of the class.

The car is designed to be moved from place to place as needed, therefore at one end there is an office and sleeping room; at the other end is a boiler room, with coal bin, water heater, etc. Between these two is located the class-room, 41 ft. long, and containing folding chairs for 18 men. In front of the students is grouped all the apparatus for instruction, and the large cut presents the view of it which each one has. The rows of rods seen on each side are the piston rods of 47 freight brake cylinders, each 8 by 12 in.; 36 being Westinghouse and 11 New York. Notice that these rows converge toward the rear, so as to bring each into plain view of the class. Besides these there are two tender brakes, 10 by 12 in., and two driver brakes 10 by 10 in., all Westinghouse, and mounted horizontally. Of these one tender brake cylinder is seen on the left of the picture, bolted to a swinging crane, by means of which it can be swung out from the side of the car into full view. Underneath this and attached to the same crane is a row of six triple valves having various defects, any one of which may be turned



Sectional Parts of Brake System

horizontally and connected with the cylinder above in imitation of actual use beneath a car.

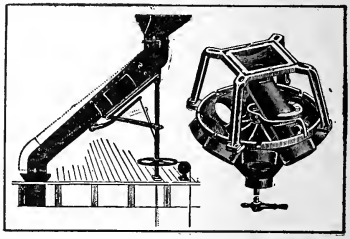
The apparatus in the middle foreground can be swung either way for explanation of sectional parts of the two systems. Above hang 14 handles of signal cords of the air apparatus, one for each car in the train.

The two small cuts present views of the same portion of the car, taken from opposite directions. It is the portion which is seen partially on the right of the large cut—a bench on which stand various sectional parts for detailed study of air-brake and steam-heat apparatus, lubricators and injectors. The car is equipped with electric light and acetylene lighting. Vertical acetylene generators appear at the right of one of the small cuts.

MYSTERIOUS DISAPPEARANCE EXPLAINED

The following incident forcibly illustrates how unreliable circumstantial evidence may be: Three years ago a man living near a mill at Oakland, Iowa, was accused of stealing 25 bu. of wheat which had disappeared mysteriously from the mill. The man and his friends stoutly asserted his innocence, and the prosecution failed for lack of evidence, but, of course, an unpleasant cloud rested upon his name. This has now been happily lifted by the tearing down of the old mill, which revealed the existence of a forgotten bin containing the 25 bu. of wheat.

In mills and elevators the grain bins are built in rows, open at the top. When the grain comes up the elevating trough it discharges into a spout. This spout is made to turn so as to empty into any bin in the mill. The turning is done with a lever on the ground floor, attached to an iron rod which extends up and is fastened to the discharge spout. The operator was



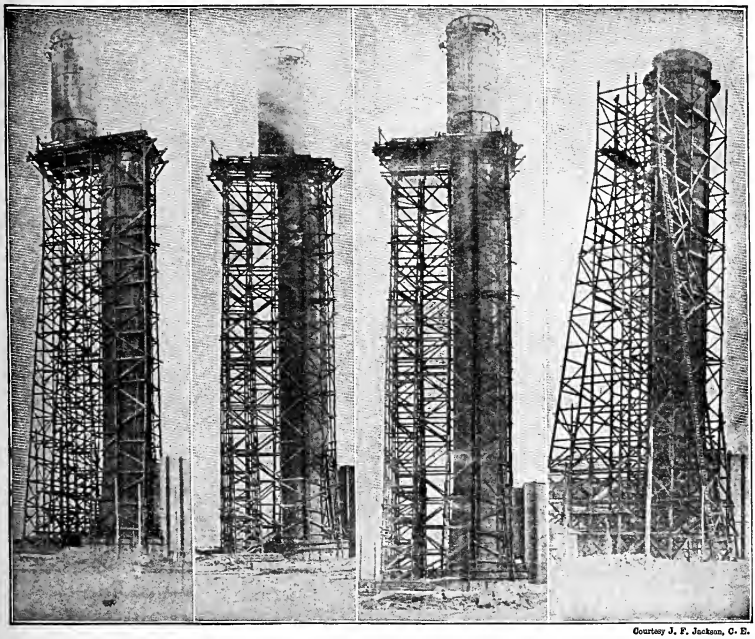
Spout Shifting Machinery—Operated from the Ground Floor

careless in setting his lever and the grain was thus run into the bin which was out of service.

From Montreal to Winnipeg, 1,430 miles, is the greatest distance the human voice has ever been transmitted. The medium was a copper wire installed by the Canadian Pacific Railroad Company for their telegraphone system, by which a telegraph and a telephone message can be transmitted simultaneously.

REMARKABLE WORK ON HIGH STACK

Section Weighing 40 Tons Added at Height of 200 Feet Without Shutdown



Courtesy J. F. Jackson, C. E.

Four Stages in the Work on High Stack

One of the most formidable of many daring engineering feats in midair was the extension of the mammoth stack at the smelter works a few miles from Douglas, Ariz. The original stack was one of the largest in the West, being 200 ft. high and 25 ft. diameter on the inside, but had become too small and an extension of 60 ft. at the top was decided on. The difficulties of the undertaking were increased by the condition that the plant could not shut down for even an hour and that the men must work on a platform 200 ft. above the ground amid clouds of smoke, deadly gases and heat constantly belching from the giant chimney.

Four months were spent in erecting the false work, which was built of 12 by 12-in. timbers braced with 3 by 12-in. material, all bolted with heavy bolts. It

was almost universally predicted that the structure would collapse under the strain, for the 60-ft. section weighed 40 tons—as much as a fair-sized locomotive. The section was successfully hoisted to the platform and then the task of shifting it into place began. The illustrations show the progress of the work at four stages. Slowly the ponderous mass moved to one side as the cloud of smoke sought its new channel. Then a signal flag fluttered from above announcing that the new section was ready to lower and attach.

The feat was accomplished in less than three hours, while in all the big plant not an engine slowed down, nor a single blower reduced its pressure, nor a safety valve popped as a result of steam generated but not used. It was an accomplishment requiring skill, science and personal courage of the highest order, as well as ability to anticipate every possible condition of failure and provide against it in advance.

PANAMA CANAL COMPARATIVELY SMALL UNDERTAKING

The building of the Panama Canal has been unduly magnified as an engineering undertaking, although it is the largest job of its kind to date. It is estimated to cost about $150,000,000, but this is less than $2 per head for each man, woman and child in the richest country in the world, or about 25 cents per head per year for eight years. That certainly will not "bust" us.

The distance from ocean to ocean is only 40 miles, and the chief engineer can go over the entire line and return by rail between breakfast and supper. Everything that modern science, in all its branches, can contribute is being utilized to do the work economically, speedily and safely. In a single machine, coal and steam, with an engineer under a canopy, do the same work which if performed in the old way would make a thousand men with shovels and wheelbarrows toil under a relentless sun. The working conditions are really easy and comfortable as compared with the privations, hardships and dangers which in the early days beset the construction of hundreds of miles of railroad in the United States.

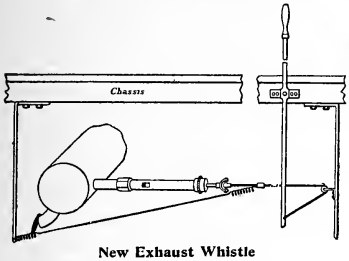
There are at this moment right here at home not a few engineering works under way, and financed by private capital, too, which in the aggregate will cost several times as much as the canal. In many respects the engineering difficulties are vastly greater than those at Panama, and, barring the one item of climate, the dangers to life and limb are even greater.

And yet so familiar are we with these things they create wonder for a few days only, and after that scarcely a passing comment. In New York City alone the great works of tunnels under city and river, railway terminals and depots, water supply and other similar enterprises now in progress aggregate the enormous sum of $625,000,000, or more than four Panama canals, while three of the undertakings amount to $100,000,000 each.

A railroad builder in Chicago whose reputation is national among railroad men said: "The digging of the canal is, of course, a big thing, but considering the facilities available for the work is relatively not a bit bigger than lots of engineering work which the railroads of this country have been doing for years past. They have not made any fuss or splurge, and for the most part the public has never even heard about it. In constructing the first track across Arizona, for instance, the men were in constant jeopardy of death from hostile Indians, thirst, starvation, poisonous reptiles, and sunstroke, and could not communicate with nearest headquarters for weeks at a time. Scores lost their lives or were devoured by wild beasts of the deserts or mountains, and to this day no trace of them has ever been found. To a railroad constructor the canal job does not present the formidable obstacles which loom up like mountains to so many people."

"NIGHTINGALE" AUTOMOBILE WHISTLE

A new whistle for automobiles has been brought out by a Paris firm, which is blown by the exhaust. It is quite musical and produces a pleasing sound, the pitch and volume being regulated by a lever operated from the seat. The accompanying illustration from L'Automobile shows the manner of mounting and operating the whistle.



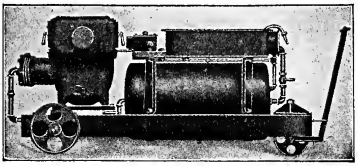
New Exhaust Whistle

The balloon "United States," in which Lieut. Lahm won the cup last year, has been purchased by the Aero Club of St. Louis.

A Japanese commission has started for England to place the contract for a battleship of 21,000 tons displacement, at a cost of $11,250,000.

PORTABLE AIR COMPRESSOR

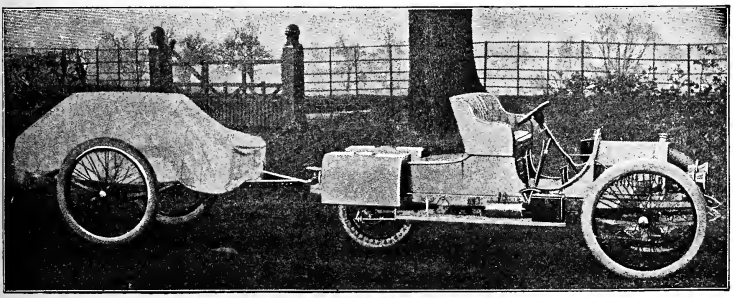
The rapidly increasing number of uses to which compressed air can be put in and around a manufacturing plant, makes a portable compressor a desirable machine. The compressor illustrated is a complete plant, operating with an electric motor and can be used wherever current can be obtained. One hundred feet of air hose is carried in the box over the storage air tank.



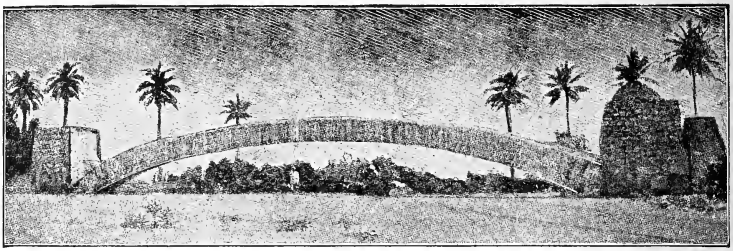
Easily Drawn About

AUTOS FOR EGYPTIAN DESERTS

The experiments with motor cars by the Egyptian government have met with such success that considerable attention is being devoted to the production of cars specially designed for work in that country. The type illustrated consists of a light weight 3-wheel motor car of 12 to 18 hp. with a 2-wheel trailer. The wheels are fitted with 5-in. tires, says the Automobile, to prevent sinking in the sand.



Three-Wheel Motor Drawing Two-Wheel Trailer



TEST BRIDGE BUILT IN A GARDEN

Almost 100 years ago the curious arch bridge shown in the illustration was built in the garden of an English army engineer, at Seringapatam, India. The structure has a span of 112 ft., rise of 11 ft., and is 4 ft. wide. Thickness at the springing is 5 ft., and at the crown 3 ft. 10 in. Ordinary bricks and mortar were used.

It seems Capt. De Havilland had recommended a 5-span bridge of similar arch construction to cross a river. He was laughed at and his plans rejected. He built the single span at his own expense, and although he lived to the age of 90 years, his demonstration has already outlasted him 50 years, and bids fair to endure for centuries.

Six British antiquated warships sold at auction for $383,000. They originally cost nearly $8,000,000.

ENORMOUS GROWTH OF CEMENT INDUSTRY

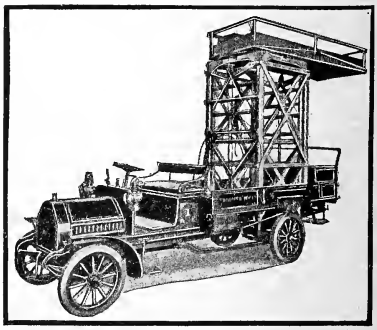
The production of Portland cement in this country has increased in 35 years from 3,000 bbl. a year to 4,000,000 bbl. in last year, and this with the prospect of an increase during the next year of 20%. Without being in the hands of a trust, the prices have increased in the past 18 months from 15 to 20% from legitimate demand.

This enormous output for 1906 would be sufficient to build a first-class cement sidewalk 5 ft. wide 3.6 times around the world, or build a sidewalk 456 ft. wide reaching from Chicago to New York.

The uses to which this material, mixed with sand or crushed stone, are put are almost unlimited. They range from the smallest culvert to the enormous concrete arches spanning our largest streams; from the humblest cottage made of concrete blocks to the finest skyscraper and office buildings built from reinforced concrete.

MOTOR TOWER WAGON

Tower wagons for constructing and repairing the overhead wires of street railways are usually drawn by horses, as a repair car can seldom get to the place on account of other cars blocking the tracks. The Toronto Railway Co. has imported a motor tower wagon from Switzerland. The tower is carried in the manner shown in the cut and



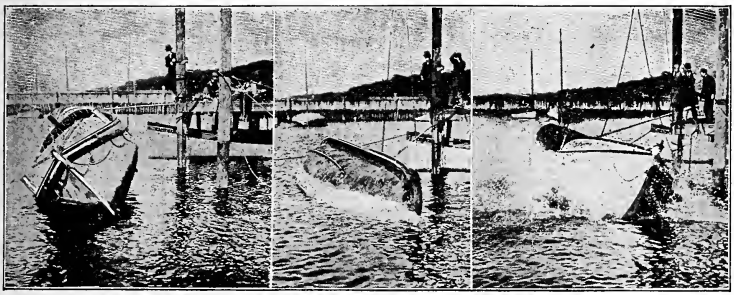
raised to double its present height when repairs to the trolley wires are being made.

LIFE-SAVING BY GASOLINE

Motor Lifeboats Can Travel 200 Miles at a Trip

In place of fourteen strong arms, pulling seven oars, with another pair at the steering oar, now a 4-cylinder 4-cycle gasoline engine pushes the craft along at 10 miles an hour. A solid 18-in. propeller, with a reversing clutch, propels the 34-ft. boat. Two gasoline tanks, one with a capacity of 25, the other with 75 gal. of the colorless fluid in which is locked up so much effort, admit a radius of 200 miles. Never lived a crew of men with the strength to pull so far without stopping—or ever will live a crew which could, even for a short distance, a long way, or where continual high seas forbid the launching of such a heavy boat, of course the early boat with its proved worth will remain.

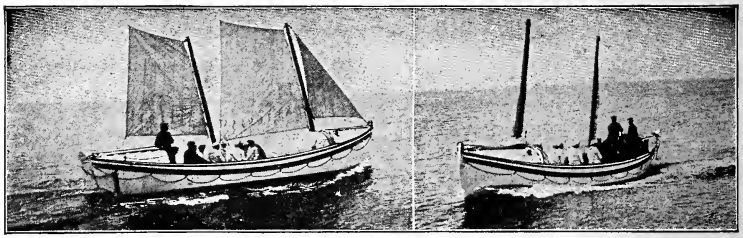
It seems odd, when one thinks of it, that a little cockle shell 34 ft. long should live and ride out seas and wind which are too much for the huge hulk which wrecks and needs assistance. But these little boats are built with one single idea—safety—and all the skill and inventive ability of the builders are designed to this one end. The boats are built of one of the most expensive materials which can be ob-



Partly Over Keel Up Self Righting

equal the speed of the little pulsating engine under the hood in the stern of the boat.

Nearly a dozen of these boats are now in use in this country, and every one has had a chance, and successfully demonstrated its superiority for the work it does, over any previous type of craft used for the same purpose. So successful are these boats that others are being built and installed—old boats, not too weatherworn, are being changed to motor boats, and as soon as appropriations allow, the work will be extended until the coasts are all supplied with these craft, wherever it is possible to use them. Where shallow water extends from the beach tained—mahogany. This because that wood is close grained and resists stress and decay much better than other woods, is so formed that it can be worked and bent and made into a boat without hurting its strength, and because it is light for its strength. Two layers are used, crossing each other on the slant, with fine canvas and waterproof paint between. The boats cannot be sunk. They have a false bottom, through which run 8-in. tubes, closed with valves, which keeps the water out. But let a wave fill the boat and in less than half a minute the water all runs out of these tubes back into the sea. The boats cannot stay upset, and turn over with difficulty;



on the bottom is a heavy keel of metal—gun metal—because that does not rust easily and because it does not set up electrolysis with the copper rivets, as would some other metals. This 1,800-lb. of keel flops a boat right side up as fast and as often as a wave upsets the boat—and it must be a mighty wave indeed which accomplishes the feat. The boat cannot sink, for there are eight watertight compartments in it, any one of which is sufficient to hold the boat on the surface full of men and women. And in these eight compartments are 82 copper air cases, so that the boat can be smashed into small pieces, cut in two, in ten, in a hundred parts, and still there will be enough floating for those in the boat at the time of the accident to hold on to.

The photographs show the difficulty which is experienced in trying to upset one of these boats. A number of men, with block and tackle, had to pull and haul a long time, until, inch by inch, the boat finally heeled over, took water, and at last turned bottom up. Released, and in a second the heavy keel flopped back the boat and in no uncertain manner—witness the splash!

Further tests showed that it took 39 men, standing on the rail of the boat, to bring it awash, and 49 men had to crowd into the hull when it rode evenly to make it take water. The engine is so arranged that when the boat tips to such an angle that the men would be thrown out, the engine stops. This is in order to prevent injury by the propeller to anyone thrown into the water and also that the boat may lose headway to make it no harder than is necessary for the men to get back into the boat. The engine is protected in a compartment in the rear, so that it does not get needlessly wet, but all the working parts are so inclosed that salt water does no damage. The engine is started, reversed and stopped by levers outside the compartment partition.

The safety and the speed of these boats are not their only advantages. In the lifeboat when the crew have to toil at the oars, but few hands are available to help shipwrecked persons into the boat or to make a safe landing beside a wreck. In the gasoline boat all the crew, save an engineer and the captain, are free from work, and arrive fresh and strong at a wreck, and can devote their entire time and attention to saving the crew and passengers. Each boat is equipped with mast and sails to use as an auxiliary or in case of accident to the power.

The limitations of the boat are only in the difficulty of launching—some sort of sheltered water of sufficient depth being essential, but it makes up for this in its increased radius, which permits it to travel 50 miles to a wreck, if necessary, distancing the ordinary surf boat, which might be launched nearer the wreck.

The cost? Eight thousand dollars for a new boat and $3,000 for putting an engine in and remodeling an existing lifeboat—little money indeed, compared with the life of the craft and its activity and the service it renders. The Life-Saving Service is enthusiastic about the possibilities and achievements of the power craft.

RAISING ALLIGATORS IN INCUBATORS

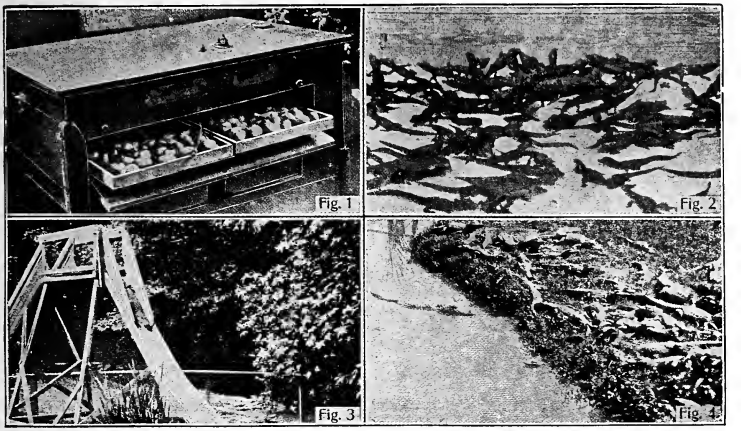


Fig. 1—The Incubator for Hatching. Fig. 2—Baby Alligators Just Hatched. Fig. 3—An Alligator Shooting the Chute. Fig. 4—A Scene at the Alligator Farm, Arkansas

Of all the interesting uses to which incubators have been put that of hatching alligator eggs is probably the most unique. An Englishman at Hot Springs, Ark., is engaged in raising alligators for the market. The demand for the hides to use in manufacturing purposes is constantly increasing, while parks and zoos buy the live reptiles for exhibition.

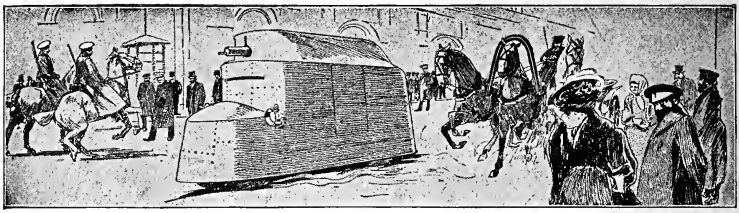
More than 3,000,000 alligators were killed in Florida alone from 1890 to 1900, and as they cannot be raised in captivity they are rapidly becoming extinct in this country. On the alligator farm, however, they have sufficient liberty to thrive. An alligator lays from 30 to 60 eggs, which are placed in the incubator, where they are hatched by the heat of the sun. Hence the condition of the weather determines the time of incubation, even in the incubator. All the young alligators of the same hatch are placed in one pen which is built to include part of an artificial lake, and in passing from one pen to another the visitor notices the increasing size of the reptiles until those 12 ft. in length are reached.

Four 'gators each 8 ft. long have been trained to shoot the chute which they do by climbing to a platform 18 ft. high, and at the word of command sliding down a 30-ft. chute into the water.

DIVERS SEARCH OCEAN BOTTOM FOR LOST MAILS

Two hundred and ninety-nine big sacks of mail were lost when the "Dakota" went down off the coast of Japan. Eighty bags floated ashore and were recovered by the postal officials who were patroling the shore. Divers from the navy were sent down to search the vessel and the ocean bottom but failed to recover anything, as the sacks had floated away.

The recovered mail was sent to Tokyo, where it was carefully dried and after inclosure in an official envelope, forwarded to destination. Over 20,000 letters and 533 registered packages were thus dispatched.



MODERN CIVILIZATION IN RUSSIA.—"One Prefect has risen to the demands of modern life in Russia. The Prefect's new automobile may be seen on the Nevsky Prospekt, steel-armoured like a cruiser, carrying its little quick-firer in a turret."—Motor, London.

MOVING HOUSE A MYSTERY

Engineers, builders and scientists are alike baffled in all attempts to explain the mystery of the "moving house" in Berkeley, Cal. It is a neat two-story dwelling owned and occupied by Mr. W. C. Webb and his family. Soon after its completion, about a year ago, the house commenced moving, apparently of its own accord, and gradually moved toward the street until it had traveled a distance of 12 ft. A few weeks ago the movement ceased.

The building has a strong concrete foundation which rests on apparently solid rock. The ground is perfectly level, and the change in position is not due to gravitation. The soil down to rock foundation is of a clayey nature.

Strange to say, the house remains perfectly intact—has not cracked, and has not lost its exact perpendicular position. Mr. Webb and his family have not moved out of the building, as it seems entirely safe. However, should it begin to move again, they will vacate. So slowly and easily has the house moved that the occupants could feel nothing peculiar.

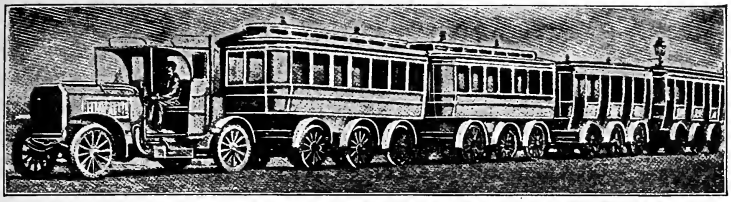
Dwellings stand on each side of this building, and singular to state, neither has "budged" the fraction of an inch from its foundations. Webb's house has reached the inner edge of the sidewalk. In his back yard there is a wide and deep—several yards—chasm extending clear across his lot; but no further earth disturbance has been manifested, except in front, where the sidewalk and street are bulged up a little.

Traveling House

NEW PROCESS FOR ALUMINUM

Although the cost of extracting aluminum by electrolysis has been reduced from $8.00 to less than 40 cents a pound, there is a "long felt want" for a cheaper process. According to The Mechanical Engineer, London, that want is now met by a method which will make vast deposits of clay a source of boundless wealth and utility. In brief the new process is this: Obtain aluminum carbide by heating kaolin and carbon in an electric furnace. Then heat the aluminum carbide with alumina (oxide of aluminum), which will yield carbonic acid gas and pure metal.

The great Assouan dam, Egypt, will be raised 23 ft. at a cost of $7,500,000.



A RENARD ROAD TRAIN now in service in England. Power from the motor car is transmitted by shafting to each trailer car, thus making each car self-propelling.

STUDENT SHARPSHOOTERS

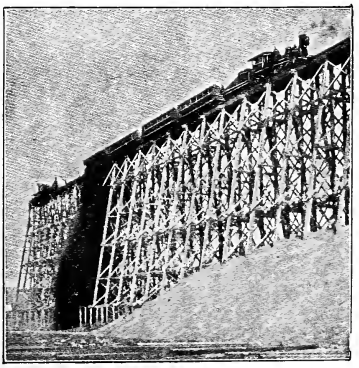
A pleasing addition to collegiate contests of "brainstorm" and football is suggested by the executive committee of the National Rifle Association of America. It is proposed to introduce rifle practice into all the educational institutions in the United States, with big intercollegiate and interscholastic shooting matches every spring. The first of these has already been announced for June 21-22 at Creedmoor, N. Y., with a handsome intercollegiate trophy. The idea deserves enthusiastic support. To be the champion shot of the student body of the United States would certainly be an honor worth working for.

RECLAIMING LUMBER FROM BOTTOM OF MISSISSIPPI RIVER

From near its source in northern Minnesota to La Crosse, Wis., a distance of about 1,000 miles, the Mississippi river flows over a corduroy bed composed of pine logs that have become watersoaked and sunk as they were being floated down stream, accumulating there through 50 years of logging. Most of these logs are of the smaller variety, 8 or 10 in. at the butt, and known to lumbermen as "pig iron" Norway. It is now proposed to lift these logs from the river and recover the millions of feet of lumber they contain. Some of the best lumber has come from logs that have lain submerged through several decades and no matter how long sound pine logs remain under water they do not deteriorate.

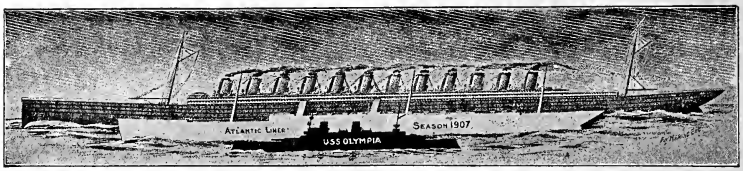
The plan is to lift the logs with a hoisting engine erected on a flatboat, place them on the river bank and have a Government scaler inspect them and record the marks found. Where the original owner can be found, he will be compensated at the rate of $8 per thousand feet. This represents so much clear profit to the owner and leaves a margin of profit to the hoisters, who can readily dispose of the reclaimed logs at from $12 to $14 per thousand feet.

A balloon occupied by two German aeronauts, ascending near Berlin, covered the 812 miles' distance to the English coast in just 19 hours, or less time than required by ordinary methods of transportation.



Courtesy Industrial Marazine.

Making a 95-Ft. Fill on Union Pacific Near Omaha



ABSOLUTE SAFETY AT SEA

Great Ships with Speed of Trains Predicted Within 25 Years

Length	1,200 ft.
Breadth	125 ft.
Depth	81 ft.
Draught	40 ft.
Gross tonnage	67,500 tons
Passenger accommodation	6,700
Engines	170,000 hp.
Speed per hour	35 miles
Cost	$17,000,000

Sea travel, because of great ships and faultless navigation, will be made absolutely safe, predicts J. R. Oldham, a naval architect, writing in the American Marine Engineer. The above figures are his prediction of the popular ocean liner within the next 25 years. The ship will have a double shell throughout, as embodied in the structure of the "Great Eastern." He says:

"In 25 years from this date a steamer approximately 1,200 ft. in length, 125 ft. in breadth and 81 ft. in depth will be afloat. This vessel will be designed for a reserve merchant cruiser. She will have a strong protective deck and a complete double shell from keel to structural deck; her top sides externally will be of nickel steel, while the inner shell will be strongly built on the cellular system with steel of exceptional ductility to permit of a great degree of buckling without a fracture.

"The bottom will also be sheathed with teak wood, which will permit of 'coppering' to avoid fouling and will add greatly to the safety of the ship in the event of grounding.

"There will be two longitudinal and 24 double transverse bulkheads extending from the bottom to the structural deck, forming coffer dams, and without any doors or port openings, elevators and stairways being arranged in every compartment. The speed will be 30 knots an hour, secured with improved turbine engines of 170,000 hp., driving five screw propellers.

"There will be 60 boilers with 400,000 ft. of heating surface, and 12 smokestacks. A special feature of the general arrangement will be extra large pumping power, with boilers and pumps placed well above the load-water line. I propose that certain compartments containing 2,500 tons shall be kept full of water, so that in the event of grounding these compartments could be emptied in 12 minutes, which would in most cases of grounding enable the ship to float off, as 2,500 tons would represent one foot draught of water."

To compensate for this loss in freight tonnage an extra charge of $25 per passenger might be necessary, but there would doubtless be sufficient travel to provide it. With proper care in navigating the chief danger would be to smaller craft which might get in collision, for the big ship at full speed would exert an energy equal to 40 railroad trains running at 60 miles an hour, or practically 3,250,000 foot-tons.

Second Lieutenant E. R. W. McCabe of the U. S. Cavalry will ride an Arabian stallion from Portland, Ore., to New York City, a distance of 3,181 miles, to determine whether the breed has the endurance required for cavalry mounts.

A gang of expert thieves stripped telephone poles of wire for a distance of three blocks in Chicago, recently, and secured in all about 600 lb. of copper.

BACHELOR OF AUTOMOBILING, NEW DEGREE?

Cornell University is certainly up-to-date. For two years past the curriculum has contained courses in all things pertaining to autos under the direction of the most competent instructors obtainable. Anyone who may imagine that, because these courses are given in a college, they are necessarily impractical, is altogether mistaken, for they include instruction in every possible detail of automobile construction, with history of each part and comparison of modern with obsolete forms, both American and foreign. Of course an important feature is the study of the gas engine and the chemical changes of combustion, with comparative efficiency of various fuels.

After theories have been mastered, comes the course in practical application, each student making drawings of some special type of engine from the principles and formulae which he has learned. These drawings must include all details as to dimensions, material, fuel, finishing, etc., and be so complete that they could be sent to a foundry and used in actual construction work. Students are required also to test the leading makes of engines for different conditions of load, speed and fuel.

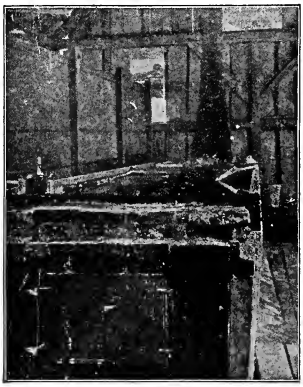
Marks Places for Planting

MAKING MAPLE SUGAR

The manufacture of maple sugar is one of the important industries of Vermont, although there is made in Chicago every month as much so-called "maple" as the Green Mountain state can produce in a year. In Vermont the process has graduated from the scattered open kettles to a system in

Scenes in Vermont Sugar Orchard

which the sap is collected in tanks on runners and hauled by team to the sugar house. The sap is transferred to



A Sugar Pan

other tanks by means of pipes. In fact the entire process has now been reduced to one in which hand labor is largely eliminated. It takes 7½ gal. of sap to make 1 lb. of sugar; a tree will yield from 15 to 30 gal. of sap annually.

WHAT ABOUT DENATURED ALCOHOL?

Well, what about it?

The law removing the tax on alcohol which has been denatured, making it undrinkable but suitable for light, heat or power, went into effect January first—two months ago.

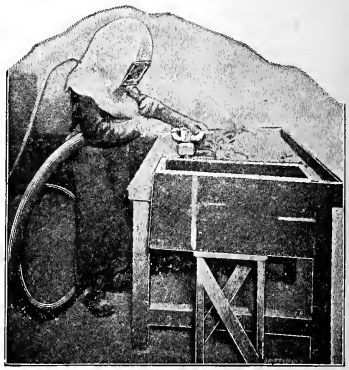
To our knowledge only one large distillery—at Peoria, Ill.—is running on denatured, and the farmer who expected to work up his frosted potatoes and decayed beets something after the fashion of apples in a hand cider press, is still feeding them to the pigs. It is given out that denatured can only be profitably produced in a big distillery costing thousands of dollars, and that the Standard Oil has arranged to control the output, making the retail price 35 cents in order to protect the price of gasoline. Incidentally we learn that alcohol will be too expensive for the many domestic utilities and that the gasoline stove is to go on blowing up in the good old way.

A large number of inquiries are coming to this magazine asking where denatured can be bought, and where can the writers procure the lamps, flatirons, cookers, and other household conveniences which have long since become commonplace in Germany.

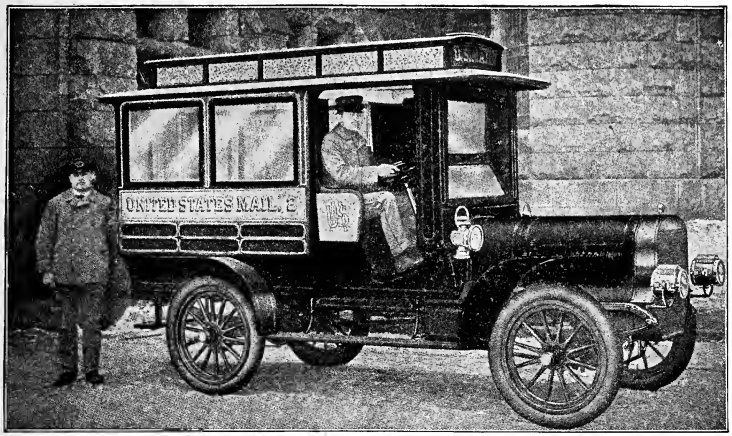
In that country denatured alcohol costs 12 cents per gallon, and it is as easily obtained as kerosene here. However there is no occasion for being discouraged; we have had it two months and Germany 12 years, and before long we shall have both the burners and the fuel. There are fine manufacturing opportunities for making these alcohol burning utensils, as well as engines of both small and large power.

Industrial locomotives for switching cars in factory yards are common in Germany, ranging from 6 hp. up. Such locomotives are also in operation in other countries, Peru for instance, has them, some of which are in use at the government arsenal.

Before many years we, too, will enjoy the benefits of this safe, inexpensive and intense heat and light.



In polishing metal parts with a sand blast the workman must protect his eyes and face from the flying particles which cut like knives. A glass window is provided in the helmet.



MAIL COLLECTION BY AUTO

Mail Faced for Cancelling in Car as Fast as Collected

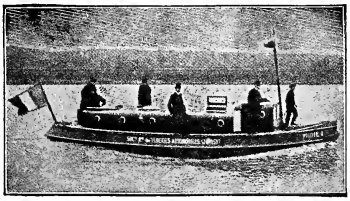
The efficiency of the U. S. postal service is to be increased as rapidly as possible by the introduction of automobiles. The feasibility of the innovation has been demonstrated; first in Baltimore during last year, and recently in Milwaukee, since Feb. 20. The postmasters in both cities are enthusiastic in their approval, and Washington, Detroit and Louisville have been selected as the next places to receive the improved service.

In Milwaukee there are three of these cars, designed by Postmaster D. C. Owen, and leased to the department by the builders at $3,500 each per year. They are under a four years' contract to furnish chauffeurs and keep the machines in first-class condition for ten hours' work daily. The service has been highly satisfactory, the cars averaging 70 miles a day each, and collecting from 500 street boxes.

Besides the chauffeur each car carries a collector, who takes up the mail and "faces" it ready for the cancelling machines immediately on arrival at the office. This means a great saving in time. The presence always of at least one man on the car will prevent robberies which occasionally occur while the collector enters an office building.

FRENCH PILOT AUTO BOAT

At the present moment there is special activity on the Seine in the trial of all kinds of motor boats. Their latest novelty is "Pilot I," a 25-hp., kerosene-driven auto, constructed specially for use as naval scout boat and in coastwise service requiring both speed and endurance. Consequently she is built strongly to stand buffeting;



New Scout Boat

completely decked, and made of steel throughout her 30 ft. of length. The screw is good for 600 revolutions a minute.

SCIENTIFIC CULTIVATION OF BACILLI

Hundreds of scientists are engaged in the work of searching for the at present unknown germ which will kill some other deadly germ. Only the few

Prof. von Behring

privileged favorites ever see the secret workroom where the cultivation of the germs is carried on year after year.

In one of the illustrations is seen the eminent scientist, Professor von Behring, seated in his bacilli breeding laboratory. The vessels on the shelves contain enough deadly germs to depopulate a big city. The other illustrations show his assistants at work experimenting on living animals in the Institute for Hygiene and Therapeutic Experiment, of which he is the director.

STREET CAR SAFETY DEVICE

An ingenious device has been invented by an employee of the street railway in Denver and is being tested. Whenever a passenger stands on the lower step a buzzer sounds in the motorman's compartment and warns him not to start the car until the signal ceases, which it does the instant the passenger reaches the platform or the ground. Contact points are placed in the step which are brought together by the weight of the passenger.

$12,000,000 FOR A SHORT CUT

There is no better illustration of the modern business axiom that time is money, than the big project undertaken by the Southern Pacific. In order to shorten its route across the Sierra Nevada and to avoid the steep grades, the railroad will soon begin boring a tunnel through a spur of the mountains which will be 36,000 ft. long, require three years of hard work, and wipe out the tidy sum of twelve millions. It will be the biggest and dearest thing in that line on this side the world. The present route will be left untouched and after the tunnel is finished will be reserved for slow, light traffic.

Inoculating a Horse, Sheep and Calf

THE TRUTH ABOUT BURNING ASHES

Recurring Discovery That Comes to Light Periodically

By Carl Shelley Miner, Director the Miner Laboratories, Chicago

Some time ago an item purporting to be sent out from Altoona, Pa., appeared in the daily papers in which it was stated that a cobbler of that town had discovered a compound which, when mixed with ordinary ashes, made of them a fuel superior to the best anthracite coal. Shortly afterward a second item informed the public that the government had become so interested in the process that it had detailed several of its experts to make exhaustive tests of the cobbler's marvelous compound. At about the same time, advertisements appeared in the papers offering for sale shares of stock in a company organized for the manufacture and sale of a compound which, when mixed with one part of coal and two parts of ashes, would produce from 50 to 150 per cent more heat than could be secured from the best coal. Up to this time the story had appeared to be only the joke of some clever correspondent. When it came to the point of selling stock, the matter assumed definite shape and the public became interested. The papers published a formula purporting to be that of the notorious cobbler, and chemists and technical men everywhere have been bombarded with questions regarding the process and its possibilities. Dozens of people over the country have experimented with it in their own stoves and furnaces, and many of them have, no doubt, considered their results as warranting a favorable opinion of the process. It is in order to make clear to the readers of Popular Mechanics certain facts chemical and practical in regard to this problem that this article is written.

The published formula is as follows: "Common salt, 1 lb.; oxalic acid, 2 oz.; water, 1 gal.; mix and moisten a mixture containing one part coal and three parts ashes, and a better fuel than pure coal is obtained." The advertisements assert that two tons of ashes mixed with 20 cents' worth of this compound and one ton of coal will produce more heat than five tons of the best fuel.

Let me begin the discussion by stating explicitly that you *cannot burn ashes.* Ashes are a mineral matter which has absolutely no fuel value. Ordinary ashes, however, contain a small amount of unburned coal, and this coal can be burned under proper conditions. Ashes and coal are of variable composition, but, for the purpose of this discussion, we will assume that ordinary hard coal contains 10 per cent of ash, by which we mean absolutely incombustible material; and the ashes from a well-regulated furnace contain 25 per cent of unburned coal, which is a liberal estimate. There would then remain 13⅓ per cent of "ashes," of which 3⅓ would be coal and 10 per cent genuine ash. Therefore the loss if these ashes are thrown away is 3⅓ per cent of the coal used. In the form of a table this statement appears as follows:

Coal contains—			
Combustible material			90 per cent
Incombustible material or ash			10 per cent
Ashes contain—			
Combustible material	25 per cent, equivalent to	3⅓	per cent of the coal used
Incombustible material	75 per cent, equivalent to	10	per cent of the coal used

So, if we admit that this method will enable us to burn all the coal in the ashes, and that is the limit of its possibilities, we may hope to save 1/33 of our coal bills. The advocates of this formula cannot claim that it contains any heat-producing material except the oxalic acid, and that is present in so small a quantity as to be negligible in making this calculation. The water and salt have

no fuel value. There is, therefore, absolutely no basis for the claim that ashes and coal mixed with this compound are a better fuel than coal alone.

This is not by any means the first attempt to produce a compound that will increase the combustion of coal in stoves or furnaces. Some years ago a combustion powder for this purpose was exploited in Germany, which appeared to be a great success, for when it was thrown into a fire the flame brightened up at once and appeared to burn more briskly. The unsympathetic government chemists, however, analyzed the powder and, finding it to be only common table salt, branded the whole thing as a fake. The salt is retained in the present formula. There have, however, been formulæ devised more satisfactory than that one. The basis of all of them is some material which will release oxygen, the gas necessary to promote combustion, in close proximity to the coal in the ashes. This result is obtained by mixing the ground ashes with the compound before putting them into the furnace. In the cobbler's formula the oxalic acid is probably intended to furnish oxygen. It contains oxygen, but it also contains carbon and hydrogen in amounts more than sufficient to combine with its oxygen, and it therefore uses up oxygen instead of furnishing it. The water is the only constituent of any possible value in this formula. It is composed of hydrogen and oxygen and at high temperatures breaks up into these two gases and so might furnish oxygen for the combustion of the coal in the ashes with which it has been mixed.

The scheme of mixing water with ashes to burn the coal out of them has been known for years and has been used by householders all over the country. It is covered by a United States patent for "a method of producing complete combustion by mixing a finely divided substance with water and introducing the same into a furnace with a heat independent of that produced by combustion of the mixture." Comparative tests made with ashes mixed with water and ashes mixed according to the cobbler formula show practically identical results. In both cases there was left about 7 per cent of unconsumed coal in the ashes. It therefore seems clear from both theory and practice that there is no new and useful improvement covered by this formula, but it is, as might have been expected, merely a rehashing of an old and time-tried method.

The probability is that neither method has any real value, but that the results obtained are due entirely to the repeated burning to which the ashes are subjected. It is reasonable to assume that if the ashes are fed back into the furnace often enough, with plenty of fresh coal, the coal in them will eventually be consumed.

It may be as well to say a word in regard to propositions of this kind in general. The cheapest form of fuel is coal. The best way to get the heat out of it is to burn it, that is, to combine it with oxygen, and the cheapest form of oxygen is the oxygen in the air.

The addition of wonderful compounds does not increase the heating power of coal, nor does it ever furnish a cheaper source of oxygen than the oxygen of the air. Keep these facts well in mind and do not allow yourself to be misled by bright flames or clever advertising matter.

What Niagara Falls Costs.—To an electrical engineer the beauty of the falls is somewhat dimmed as he reflects that the 3,500,000 hp. is worth more than $100,000,000 a year.

A Genuine "Trouble" Line.—To avoid a personal conference the Shah has had a telephone line built from his palace to the public square for the use of subjects having grievances to present. When he gets enough troubles for one day he gives the "busy" signal. The Czar might profitably employ a few thousand miles of wire in the same way.

HOW PAINT IS MADE

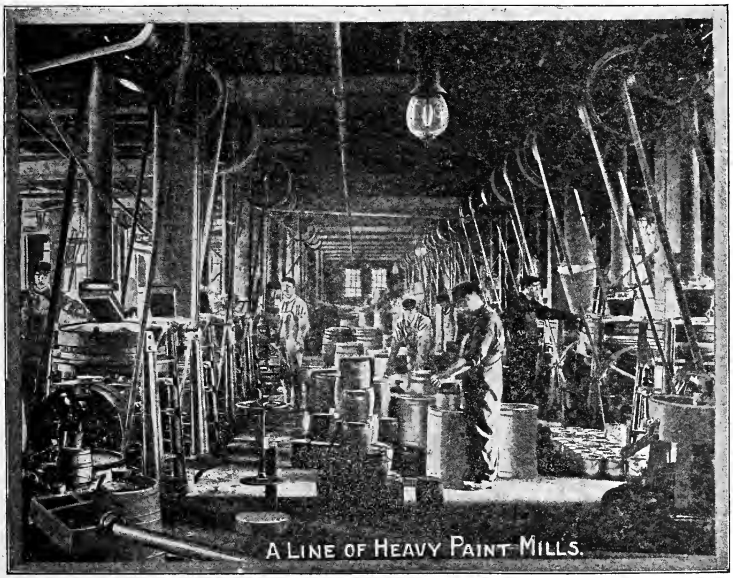
An American Industry—Few People Realize Its Magnitude

By J. Oliver Curwood

Of all those products with which America has taken the lead in the struggle of nations for industrial supremacy paint is one of the least known, so far as its making is concerned, and almost without knowing it the people of this country have had developed under their very eyes an industry which had the honor of being spoken of in Congress recently as "a rival of the steel industry so far as rapid growth is concerned, an industry which is of incalculable value to this country, and one which should be protected and encouraged by every manner of means."

This was spoken apropos of a movement to have distributed throughout the country millions of pamphlets, encouraging home owners to care for their buildings, and telling them how to do it, just as the Government is giving in this same way its advice and support to the nation's farmers.

As in nearly everything else, mechanical and inventive genius have placed the United States at the head of all other nations in the manufacture of paint. America is the home of "templates," of standardized screws, bolts, rivets, etc. The Yankee mind is given to short cuts. From machinery it cuts away useless metal, needless wheels, superfluous parts. It rejoices in new and better ways of doing old things. That is why American engineers were ready to guarantee the completed Nile bridge in less than one-fourth the time and at a much lower cost than the English builders. And



A LINE OF HEAVY PAINT MILLS.

that is why this country has today become the "paint pail of the world"—so quickly, too, that Americans themselves hardly realize the fact.

In 1860 there was not a gallon of machine-made paint in the world. Today there are 250 paint factories in this country. They represent a capital of nearly a quarter of a billion dollars. Last year they produced 80,000,000 gal. of paints, and the steadily growing demand, especially from abroad, where the superiority of American paint is as conceded as that of American steel, it is expected will bring this year's product up to 100,000,000 gal. American machinery has made this tremendous output possible. It has also made it possible for the home owner to go to a store and pick from a shelf any tint or variety of paint he wishes, a gallon costing him less today than a gill of drying oil would have cost a century or so ago.

There is not one person in ten thousand who knows how paint is made today; not one in that number who knows that white lead is only one of several valuable bases, and that modern scientists have discovered other and equally good things to take the place of turpentine in many paints, which will soon be so scarce and high that were it exclusively used in paint manufacture a gallon would cost several times what it does now. This fact brings us to the first step in modern paint making—the work of the scientific department. Every big paint factory has its laboratory, which is equipped with as high-priced men and apparatus as the scientific department of a pharmaceutical concern. These men, over 1,000 of them in this country, are constantly at work striving to make their products better and cheaper for the public at the same time, for in no other industry is competition between manufacturers more keen. No sooner does one firm put out a new paint than it is analyzed by its rival firms, and the good qualities of the new paint are incorporated in their own. To this department of a paint factory first comes all of the material which is to go into paint. In a big room is a miniature paint plant. There are miniature grinders and mixers in which only half a pint of paint can be made at a time. A certain batch of material comes in. It is first proved in this miniature factory, and if the chemists say it is all right, the material goes to the factory proper.

First the "base" is made. Perhaps half a barrel of zinc white, white lead, or some other base substance is dumped into one of the big, churn-like mixers. To this is added linseed oil. Then the "churn" is set in action, and steel paddles begin whipping the mixture. This "churn" looks like a simple invention, yet it is a product of the last ten years in its perfected form, and its existence has lowered the price of paint a half. For an hour its paddles stir the base. Then this base, after coloring matter has been added to it (if a colored paint is desired), is slowly run into a grinding machine.

Paint is a combination consisting of finely ground pigments suspended in a liquid menstruum, and the more finely the pigments are ground the better the paint. Because of this it may be safely said that this "mixer" is the invention which has made America the "paint pail" of the world. While the paint makers of other countries were grinding their dry colors in oil with slab and muller this piece of machinery was creating new paint factories all over the United States. Imagine two huge steel "grindstones" fitted close one upon another, and revolving slowly in opposite directions with tremendous pressure from both below and above, and you have a good idea of a grinding machine. Between the surfaces of these "stones" the paint slowly runs until the pigments are ground to microscopic fineness. When it oozes from between them it has had brought upon it a grinding pressure of several tons, and is in its finished form. Linseed oil and turpentine or some other thinner is then added to it in other "mixers," when it is ready to be placed in cans.

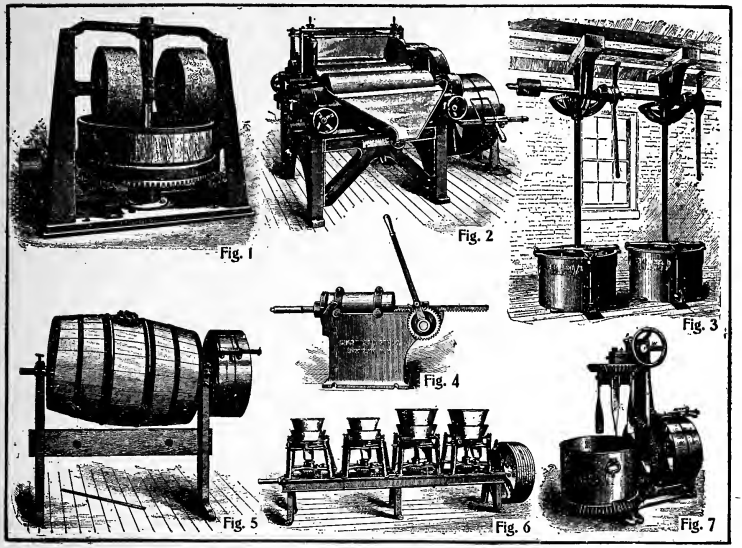


Fig. 1--New Portable Revolving Bed Chaser or Pan Mill. Fig. 2--Three Roller Mills. Fig. 3--White Lead and Color Mixers. Fig. 4--Collapsible Tube Filler. Fig. 5--Eccentric Varnish Cutter and Mixer. Fig. 6--Color Mills. Fig. 7--Ink Mixer

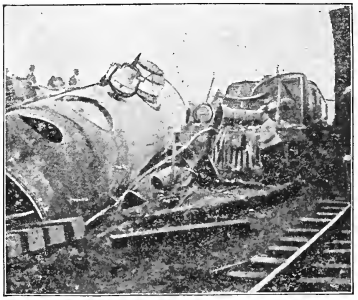
It is pointed out that in other ways than its actual product is the paint industry valuable to the country. For instance, it has increased the production of flaxseed from 10,000,000 to 35,000,000 bu. annually, and it has increased the annual smelter output of pig lead from 200,000 to 350,000 tons a year. It is also offering unexcelled opportunities for young men. So rapidly has the industry grown, and so fast is it developing at the present time, that it is difficult to secure a sufficient number of the right sort of men. Scientific care is necessary in the making of American paint, and thousands of young men are now working from department to department of the country's paint factories in order that they may be given a thorough understanding of the business. Nearly every big factory tutors many of its employes in this way, and it is frankly conceded by them that within a few months these men are earning wages which it would take them years to arrive at in nearly all other manufacturing occupations. Even at this the constant cry of paint manufacturers is "Men—men—we want men."

That the paint industry is bound to be one of the two or three biggest things in the country seems evidenced by the investigations of those who favor the "pamphlet education" scheme, which show that there are about 5,000,000 property owners in the United States whose loss through not properly caring for the exteriors of their buildings is about $35,000,000 a year. When these are added to those who already use paint, and when the constantly increasing foreign demand is taken into account, it is pretty safe to say that the paint making business will increase in prodigious leaps during the next three or four years.

Ice from frozen sea water is fresh.

LOCOMOTIVE COLLIDES WITH ITS OWN BOILER

The strangest freak of all the queer accidents in the line of railroad collisions happened recently on the Southern Pacific near Gilroy, Cal. A loco-



A Freak Wreck

motive actually collided with its own boiler.

The locomotive was a mammoth one of the Atlantic type and was hauling a passenger train at the time the huge boiler exploded with a noise heard for miles around. The boiler went up into the air and landed on the track 200 ft. ahead, leaving the trucks, drivers and engine frame. The boiler fell in time to be run into by the remaining portions of the locomotive, which were carried forward by the momentum of the train, which after shoving the boiler a short distance came to a stop. The engineer, fireman and superintendent of block signals riding in the cab were all killed. The accident occurred in the night. The illustration is from a photograph taken the next morning.

BURY OUR GOLD IN GUAM

Among the natives of Guam, American gold coin is held in high esteem —at a high premium. So high, in fact, that whenever the natives get hold of a gold piece they proceed at once to bury it, thus withdrawing it from circulation. It is for this reason that the governor of the island has very recently requested the Navy Department to send only currency instead, in bills of the denomination of $1, $2 and $5. Fifty thousand dollars in bills, as requested, will be sent soon to the island by the Government transport sailing from San Francisco.

Guam is between Hawaii and Japan, where a United States coaling station is maintained.

A TELESCOPE LINE

A simple system of observing objects and places concealed at a distance is being demonstrated in Massachusetts. By this means it is expected that a manager, for instance, can sit in his office and actually see what is going on in any department of a large works. If the plan succeeds it will be possible for a central office to watch the interior of all the banks in a city.

The system consists of tubes or pipes with branch tubes proceeding from the main tubes at angles, and mirrors for reflecting the rays of light from one tube to the other.

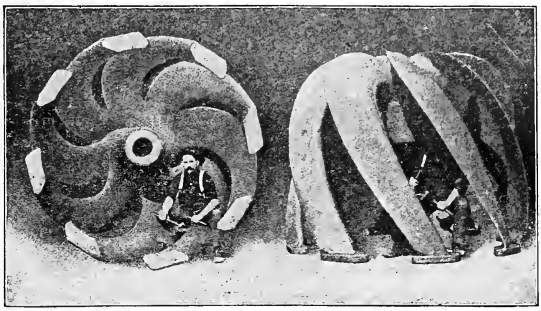
At the observing end a pair of field glasses magnifies the reflected image where the distance requires it. The

The Observing Instrument

pipes can be laid underground, and through walls, or wherever necessary to secure the desired connections.

REMARKABLE STEEL CASTING

This is not the picture of a devil-fish swallowing a man, but of a cutter for a government suction dredge, for which we are indebted to courtesy of the American Machinist. The man in the case emphasizes the size of this huge steel casting, of which the height is 6 ft. and the diameter 7½ ft. The difficulties of so large a steel casting can hardly be appreciated outside the foundry. When the metal was ready to pour, the mold represented 19 cores rammed up in a flask 12x12x11 ft. Almost 4 weeks were spent in assembling the parts. The casting was a perfect success, showing neither settles nor shrinkage cracks. The casting weighs 10,540 lb.



Height, 6 Ft.; Diameter, 7½ Ft.; Weight, 10,540 Lb.

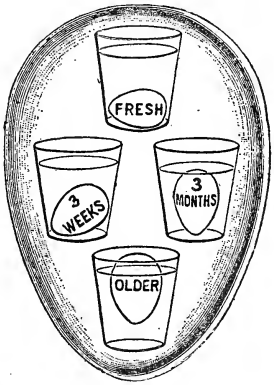
DIGGING COAL WITH A DREDGE

What is the use of picking coal out of the bowels of the earth when all that is needed is a No. 6 sand pump attached to a 13-hp. portable engine on a raft and a scow on which to load the coal? That is the way they do it on the Susquehanna, 16 miles above Harrisburg, to the tune of 25,000 tons of the best quality of anthracite yearly. The same is now being done at other points along the river.

The explanation of this apparent marvel is quite simple. The anthracite is a fine deposit, which has been washed down by freshets from the coal and culm piles along the banks, and it ranges from pea to buckwheat size, with a little chestnut. These deposits are of exceptionally fine quality, for the down stream motion has a sifting action, separating slate from coal, because the former is too flat to be carried readily by the water. The deposits collect especially in eddies, on sandbars and below bridge piers.

TO TELL THE AGE OF AN EGG

A fresh egg will sink when placed in water and rest on its side; if three weeks old it will incline slightly with the small end down; if three months old it will stand on the small end, and

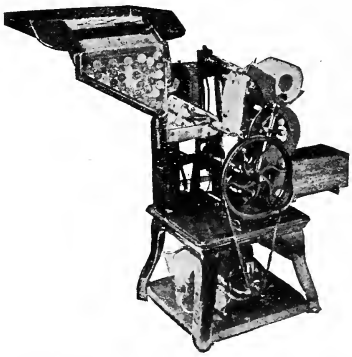


Testing Eggs

if older it will float with large end out of water more or less, according to age.

COIN COUNTING MACHINE

The illustration shows a new English machine which automatically counts coins and rolls them securely in a paper wrapper. The coins are



Counts and Wraps the Coins in Strong Packages

emptied into the hopper at the top and come out counted and wrapped at the bottom as fast as six men could do the work by hand. The machine cannot make a miscount. It is operated by an electric motor.

BIG SCHOONER HAS GAS ENGINES

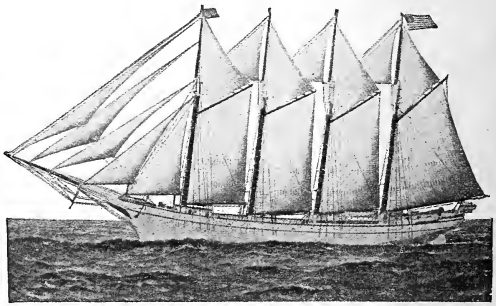
The old time mariner refuses to compromise and allow either a steam or gasoline auxiliary engine. He wants all sails or all power. The idea is losing ground, however, and recent ship construction has demonstrated the advantages of a gasoline engine for use when little or no wind prevails. One of these vessels, the "Northland," plying along the Atlantic coast, is a 4-masted schooner spreading 9,000 ft. of canvas; her dimensions are: Length, 242 ft.; breadth, 44 ft.; depth, 26.6 ft. Her masts are 161 ft. high; her cargo, 3,000 tons.

One 500-hp. gasoline engine gives the schooner 5 knots an hour in calm weather. Another smaller gas engine lights the vessel and furnishes an electric searchlight which is something unusual for sailing craft; and still another engine hoists the sails and anchors, and hoists the cargo in and out of the five hatches.

The success of the "Northland" is likely to be immediately followed by the construction of many others using gasoline engine auxiliaries.

NEW COAL FIELD; 24 FT. THICK

The day when all the coal shall have been burned up has received another big postponement. Word comes from England of the discovery of a mammoth coal seam, 24 ft. thick, and covering 2,000 acres, in South Staffordshire. To be sure, it is rather deep—1,750 ft.—but that difficulty will be overcome by means of new machinery, both hydraulic and electric. The cages will be lifted by hydraulic power according to designs which will combine the best features of American, English and German machinery. Lighting and hauling will be done by electricity. By these improved methods it is expected to obtain an output which will beat all

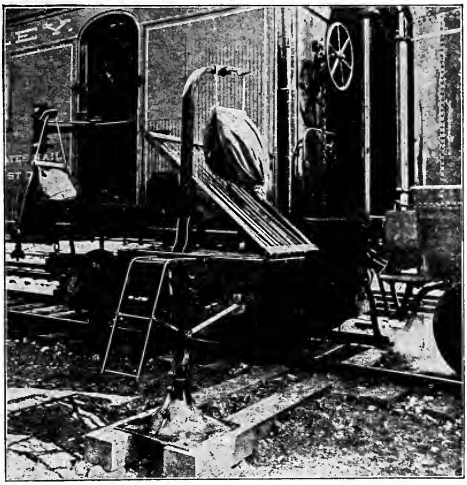


The New Way—Power and Wind

records—3,200 tons in 8 hours—and keep 2,000 miners busy.

DELIVERS MAIL AT 70 MILES AN HOUR

The new mail handling invention shown in the accompanying photograph will both receive and deliver mail sacks at the same moment, and, with this task accomplished, automatically swing on its own axis out of the way of trains which follow. The Government insists that a mail-catching device shall be equal to the task of being operated while the trains are running at a speed as high as 60 miles an hour. Tests of this machine have proven that it will receive and deliver mail to trains running at all the different speeds up to 70 miles an hour. As shown in the photo, the machine is equipped with a kind of reversible cradle of steel wires which hangs from a crane and the crane in turn is suspended from a swivel post. Another important feature of this invention is found in the fact that it holds the mail pouch which is received by it tightly, thus avoiding any possibility of its falling under the train wheels.



"Welcome the Coming: Speed the Parting" Sack

LIABILITY FOR "LARCHMONT" WRECK ONLY $103.12

Don't get drowned; it is better to be killed on a railroad—that is, it is better for your family. Owing to a peculiar Federal law the liability of a steamship company for a disaster is limited to the value of the wreck. The Joy Line, to which the steamer belonged, has filed a petition under this law, setting forth that the wreck has not been located, that the total value of the property recovered from it is only $103.12, and asking that their liability be limited to that amount. That would produce 56 cents for the heirs of each of the 183 persons lost. We suggest that the Joy Line should change its name, which it will probably be glad to do after reading the following newspaper dispatch:

"The wreck of the steamer "Larchmont" has been found by a fisherman off Watch Hill, R. I. It has been sought for more than a month, and the United States revenue cutter "Cactus" will proceed to the spot and endeavor to recover any bodies which may still remain in the wreck."

UNITED STATES NEGLECTS ARSENIC PRODUCTION

Over half the world's production of metallic arsenic, white arsenic, and arsenic sulphides is utilized by the United States, the supply coming largely from England, Germany, Spain and Canada. There are extensive deposits of arsenical ores in this country, and every year several hundred tons of arsenic sulphide, obtained in purifying sulphuric acid at chemical manufacturing works, are wasted by burial; yet we remain dependent on foreign countries for our supply.

ELECTRIC BOUQUET A NOVELTY

A pleasing electric novelty which any electrician can easily make is the electric bouquet. The idea is suited to many occasions, such as receptions, weddings and presentations. In a large bouquet or design of natural flowers are placed small incandescent lamps, either white or colored, arranged in the form of letters to produce either initials or words. For example, on the recent occasion of a reception given by his employes to their manager on his return from a long absence a mammoth bouquet of roses was presented to him, in the middle of which glowing in soft colors was the word "Welcome." Current was taken from a wall bracket through a flexible cord 20 ft. long, which permitted the bouquet to be carried about the room.

AN EARTHQUAKE HOUSE

It is to be built in Kingston, Jamaica, of drain pipes set on end and filled with cement, faced on the outside with cement and on the inside with thin wood. To one who has never "quaked" it would seem that a house of solid concrete would be far more likely to withstand shocks, and still better would be the light frames which they put up in Japan, but a man who has been there says it's all right. He ought to know, for he is Col. H. E. C. Kitchener, oldest brother of Lord Kitchener, and a resident of Kingston. His house was badly damaged by the last shake, and he is now in England buying materials for the above mentioned style of house, so as to be ready for the next one.

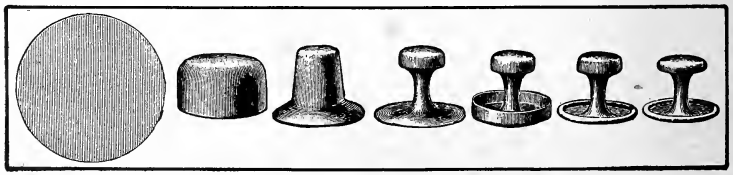
SUBWAY IN TOKIO?

In their omnivorous appetite for everything "Western" the Japs are eager to add underground railways to the large collection which they already possess. So far, however, the subway is "all in the air," for the company is not even formed. If it materializes, the distance is to be 12 miles and the fare $2\frac{1}{2}$ cents.

Meanwhile the Tokio Electric Tramway Co. is trying to get permission to add 60 miles to its line.

MAXIM'S LATEST PEACE PERSUADER

It has been predicted that the more highly perfected became the weapons of destruction, the more unlikely would the nations be to resort to war. If that is so Hudson Maxim, the well known inventor of high explosives, is a universal benefactor. His latest peace-persuaders are "stabilite" and a perfect time fuse. Stabilite is a new smokeless powder having certain advantages over the usual smokeless — it will not



Seven Stages in the Manufacture of a One-Piece Collar Button

decompose; is not affected by impurities; can be used as soon as made. By the time fuse a shell may be caused to explode after passing through any thickness of armor, making most of the crew permanently peaceable.

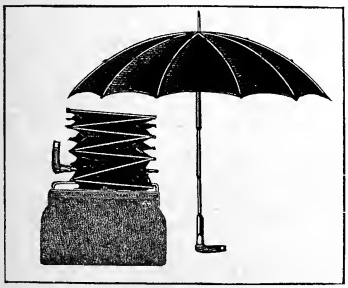
Mr. Maxim insists that the United States would be practically defenseless in case of war with any first-class power.

WELLMAN ARCTIC BALLOON TO SAIL THIS MONTH

The Wellman balloon, "America," for Arctic exploration has been entirely rebuilt, nothing of the first construction remaining save the gas bag and a single motor, and is now en route for Dane's Island, north of Spitzbergen and only 600 miles from the Pole. Only Felix Riesenberg, of Chicago, and two Norwegian companions remained at the headquarters in the frigid zone the past winter, during which time communication has been entirely cut off. Much depends on whether Mr. Wellman finds the big balloon house erected last summer still standing. If the winter storms have wrecked it, another will have to be built.

A FOLDING UMBRELLA

The latest Paris fad in umbrellas is one which folds up in a case which can be carried in the pocket of an ordinary coat. The illustrations show the case, umbrella half opened and also ready for use. The handle telescopes and the ribs are hinged to fold several times. The umbrella can also be used as a cane.



Folds to Pocket Size

TAXIMETER COMPUTES CAB FARES

With the advent of any mechanism which shall fix the fare due at the end of a cab-ride, one of the chief diversions of Cabby will be gone. But cab-riders will rejoice with exceeding great joy.

Registers Everything but "Tips"

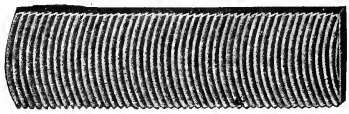
Across the sea comes news of the general adoption of a "taximeter" for every hired vehicle in Paris, its adoption ordered in London after June 1, and now one forerunner of this peace-preserving innovation is exciting much interest in New York City.

Without going too far into details, it may be said that the French device displays on its face, in plain view of the traveler, the fare due as fast as it accumulates, and this goes on just the same when the cab is standing still for a call and whether it travels fast or slow. The machine is operated by

clock work and connection with one wheel, and is sealed so its mechanism cannot be tampered with.

FILE WITH CIRCULAR TEETH

A new style of file comes from London, for which several good things are claimed. From the accompanying cut



Courtesy Machinery

The New File

it looks reasonable that this file should be self-cleaning, the chips being pushed continually toward the outer edge. The grooves are so deep that they cut without slipping and last longer without sharpening, which can be done much below the usual cost because of the simple shape of the teeth. It is claimed to work well on all metals and even marble.

PROMOTION OF THE DEAD

All the 107 men whose bodies were found in or near the hulk of the battleship "Jena" have been promoted. It will be recalled that the "Jena" was wrecked recently by the explosion of its magazines when the ship was in dry dock at Toulon. Only 58 of the bodies have been identified, so that the chief significance of the promotion lies in the fact that the widows and other relatives will receive higher pensions in consequence of the promotions.

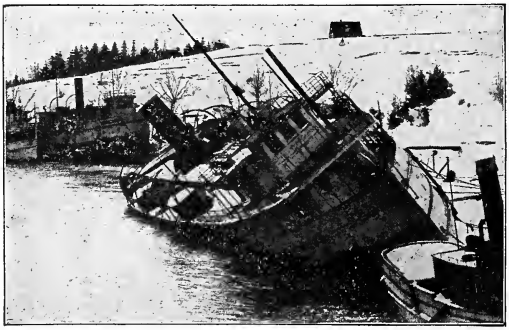
38 1-2 MILES AN HOUR BY AUTO

That was the average speed made by M. Sorel, from Paris to Nice, in a 60-hp. car. Done on a wager, full time, 16¼ hours.

BIGGEST WHISTLE IN THE WORLD

The biggest steam whistle in the world is on a street railway power house at East St. Louis, Ill. It is a three-chime and can be heard 20 miles. It takes half a ton of coal to produce the steam necessary to blow the whistle one minute. The "whistle" is really three whistles, the largest of which is nearly 6 ft. high and almost as large around as a man. It has connection to an electric clock regulated by Washington time and is blown for 10 seconds at 7 a. m., 12 noon and 6 p. m.

RAISING A SUNKEN BOAT

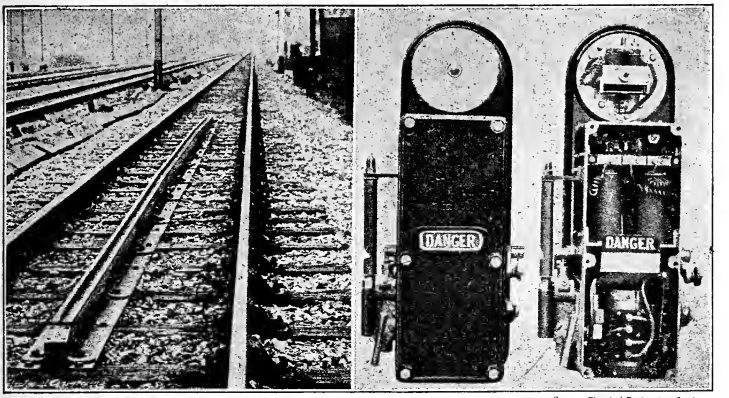


Trying to Be a Submarine

The screw propeller "Minnie M.," in summer service on Georgian Bay, filled with water while at her winter dock, sunk and then rolled over on her side. The boat was raised by coffer-damming the engine and boiler room and the hatches, and while the pumps were removing the water five heavy lines were carried to blocks fastened on shore. As the water was pumped out the boat gradually righted herself and was taken to the repair docks under her own steam.

NEW RAILROAD DANGER SIGNAL

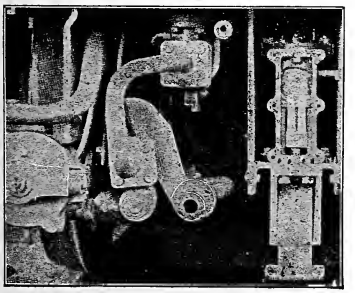
By Which Train Dispatcher Can Warn Engineer of Moving Train



Courtesy Electrical Engineering, London

Signal Rail Closed Open

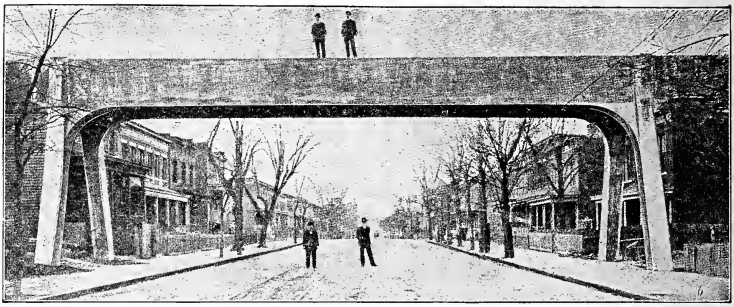
A new system of signals has been installed on 22 miles of the Great Western Railway of England. It signals the engineer of a train while running at full speed between stations. A section of third rail 60 ft. long, called a ramp, is placed in the middle of the track at intervals of each half mile. A contact shoe suspended from the locomotive makes contact with each ramp as the train passes. Electric wires connect the ramps with the telegraph office in the company's signal towers. The operator can thus cause the signal box in front of the engineer to ring a bell to indicate a "clear" track, or blow a whistle and show the word "danger."



Contact Shoe is at the Right

FIFTY MILES TO THE MOON

So far as seeing it is concerned. Thanks to Mr. John D. Hooker, a philanthropist living at Los Angeles, we may some day see photographs of the moon's surface distinguishing objects 100 ft. apart. In other words, anything they have up there half as long as the capitol building will be plainly discernible. All this and many greater wonders will be brought about by means of a 100-in. mirror, which will be mounted in the Carnegie Institution's new solar observatory on Mount Wilson, Southern California. But it is several years in the future, for first a 4½-ton block of glass, 13 in. thick, must be cast without crack or blemish, and then four years must be consumed in just grinding and polishing it. The cost of the big mirror and its smaller auxiliaries will be $45,000. A lens of equal size costs $1,000,000.



Courtesy St. Ry. Journal

ELEVATED RAILROAD BUILT OF CONCRETE

The feature of greatest popular interest on the new electric railroad from Richmond, Va., to Chesapeake Bay is the elevated part, 2,800 ft. long, where the road enters Richmond from the north. The height of the structure varies from 18 to 70 ft.

The plan of a riveted girder viaduct was rejected on the ground of expense, a wooden trestle was considered too temporary and too liable to destruction by fire, so concrete reinforced by steel was adopted. The cement used was of the best grade and the stone was granite crushed and thoroughly screened to 1 in. Granite dust was substituted for sand, being found to have 20 to 50 per cent more tensile strength. The mixture was in proportion of 1:2:4, and was calculated to stand a compressive stress of 500 lb. per sq. in. and a shear of 50 lb. All concrete was required to go into the molds within 15 minutes of mixing. After removing the molds small holes were filled with a 1:2 mortar and finished off with cement and sand laid on with a brush.

The spans of the viaduct vary from 23 ft. 6 in. to 67 ft. 5 in., the longest spans being over streets. They were planned to support a train weighing 150,000 lb., and expansion is provided for at intervals of 200 ft. by means of sliding joints. The track rests on oak ties, and these on pine stringers which rest directly upon the concrete girders. At intervals of 5 ft. a $\frac{3}{4}$-in. bolt, sunk 9 in. into the concrete, passes up through stringer and tie, and half way between these long bolts are short bolts which go through the stringer only.

LOBBYING WITH AUTOMOBILES

The Wisconsin legislature threatened to pass a law reducing the speed limit of automobiles below 12 miles in towns and 20 miles in the country. To demonstrate that such action was unnecessary several leading owners of fast cars took the lawmakers out for a spin of 30 minutes each, during which the cars were driven at speeds ranging all the way up to 40 miles an hour. Each machine was equipped with recording instruments. The tests included emergency stops and other features of control.

MAKING STEEL EXPERTS

The Bethlehem Steel Works proposes to furnish a course of free instruction for 3,000 young men, with a view to making them experts in the manufacture of steel. About 200 have already accepted the offer, and although the works are near Pittsburg, not one student came from that city. More than half of these ambitious boys are of German descent, one-fourth are Irish, and only one-fifth "strictly American"—whatever that may be.

LOCOMOTIVE AND STEAMER IN COLLISION

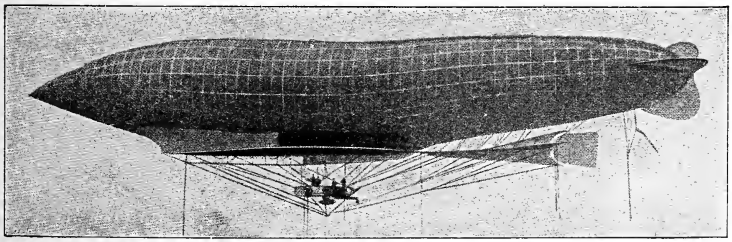
The cobbler should stick to his last and a boat should stay in the water—seems to be the moral of a queer accident which occurred near Beulah, Mich. A small steamer was trying to play turtle by getting across country with the help of several men, horses and bobsleighs. At the crossing of the Ann Arbor railroad the boat was nearly safe, when the men were terrified by the approach of an express train threatening them in the darkness. In an instant there was a terrific crashing and splintering, with wild jumping from both boat and train. Net results: A sternless boat, a pilotless engine, a speechless crowd, and no one killed.

THE BATTLE OF THE AIR

The dove of peace seeking an olive branch, whether on land or water or in the air, is liable to be shot to pieces by the target practice of nations professing to hope that they shall not learn war any more. Even if she were a duck and could dive she would be run down or blown up by a submarine. Near Danzig the German war department will practice all kinds of shooting at balloons, both free and captive, their size being 2,500 cu. ft., and the length of the holding cables being 3,000 ft. They will also try to find out how much damage could be inflicted from a balloon or airship on an enemy beneath.

THE BIGGEST LEATHER BELT IN THE WORLD

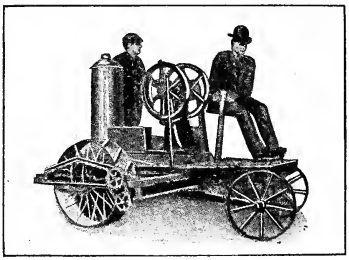
It was made in Chicago and runs a saw mill at Tacoma, Wash. It is 114 ft. long, 7 ft. wide, 3-ply thick, weighs 2,300 lb., and 225 steers contributed the centers of their hides to make it. Notwithstanding its size and weight, and the tremendous strains to which it is subjected, not a peg, rivet or any metal fastening whatever holds it together. It was simply stuck together with best quality of cement under 250 tons pressure.



War Balloon Built on the Lines of a Fish

HOME-MADE TRUCK FOR GASOLINE ENGINE

By using the truck from an old steel binder and buying a small wagon wheel and a few extra bolts, a young farmer rigged up a good truck for mounting



Home-Made Traction Engine

his 1½-hp. gasoline engine. He put a plank platform on the truck and used the same gearing that had been used to run the binder. A sprocket-chain belt was run from the engine through a hole in the platform down to the pulley, and the outfit moved itself along nicely.

This portable engine is used on the farm for the following purposes: Pumps water for stock at a cost of 7 cents a week; saws wood; cuts corn fodder; runs grindstone, fanning mill, and corn-sheller.

MELTING OLD TIN CANS PROFITABLE

Old tin cans which are not left to kick about alleys and vacant lots are collected and turned to profitable use. When reduced they are worth $5 to $12 a ton. There are several methods. The simplest is to melt the whole mass of tin, solder and iron into rough ingots, which may be used for sash weights, etc. To separate the tin completely a chemical reaction is necessary. After melting out the solder the combined scrap iron and tin must be exposed to the combined action of some free alkali, preferably caustic soda, and electricity or air at 250°. One process is to dump the scrap on an endless moving frame which carries it alternately into and out of a vat of alkali in solution, caustic soda or potash. The frame is connected with the positive pole of a current of high amperage, and the tin is soon deposited in the solution as crystals, leaving the iron free. Afterward the crystals may be reduced easily to block tin and the solution used continuously, so that the expense of the whole is slight and the pure tin is valuable.

PROPOSED TEST OF DEATH

There are some unfortunates who live in constant terror of being buried alive. Although there is no reliable evidence that the mistake occurs so often as these people imagine, the horror of it is so great as to justify them in demanding that the chances should be reduced to a minimum. Many devices have been proposed and some adopted, but none is entirely reliable.

The latest suggestion is a French invention which consists of a piece of paper, copper, brass or silver on which words are written with a solution of a neutral acetate. The piece is then fastened at the nostrils of the subject with the written side next the face. If decomposition occurs it will begin within the body, and the sulphurous gases will escape through the nostrils, in

"The Piece Is Fastened at the Nostrils"

which event the writing on the paper will be made visible by the chemical

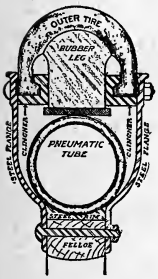
action of the gas. In this way death would actually announce itself. While the test has the advantage of being one which need not require a physician, as it can easily be applied by anyone, the serious objection remains that sulphurous gases sufficient to bring out the writing frequently occur to the living in certain cases of stomach trouble.

ARTESIAN WELL RUNS ELECTRIC LIGHT PLANT

An enterprising South Dakota farmer makes his artesian well run an electric light plant, and so successful is his plan that other farmers are adopting it.

A motor which had been in use on the well for some time is used to generate the current. The well is a 2-in. one of good pressure, and the wheel, which is somewhat larger than other moter wheels, is driven at 450 r. p. m. The dynamo, of 600 watts capacity, supplies 12 incandescent lamps and an electric stove. Only two lights can be used while the stove is in use.

AUTO TIRE THAT CAN'T PUNCTURE



Over 10,000 miles without a puncture or one cent of expense for repairs is the record of the automobile tire shown in the accompanying cut. This tire recommends itself for running over wire nails, glass, broken rocks, and any and all of the things which accidentally or intentionally are found wherever motor cars go. The outer tire is solid rubber 1 in. thick; other details will be readily understood from the illustration.

MOTOR HEARSE FOR BERLIN

In one California city an auto-hearse has been in successful use for several months. So far as known the first vehicle of the kind in Europe has just been put in service in Berlin. The approval of the police department was necessary and this has been secured. With the motor hearse it is announced that funerals will take place in one-third the time.

For "Rush" Funeral

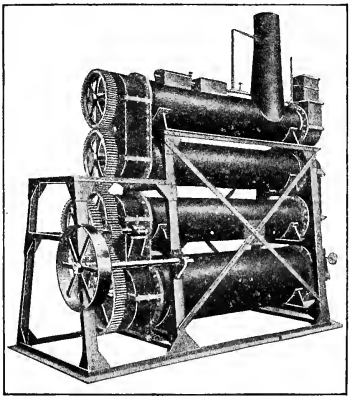
A GIANT SMELTER

In an age of electricity copper becomes the "precious metal." That means bigger and better smelters, and plenty of them. The biggest yet is now going up at San Bruno Point, 8 miles south of San Francisco, and will cost $5,000,000 and two years of work. When finished, the plant will take copper ore only, expected to come from mines all along the Pacific coast, from Alaska to Valparaiso, but principally from Nevada, Arizona, California, and Mexico. Of course the distance will depend on the richness of the ore, but this smelter is expected to reduce even 2% ores profitably from short distances. At any rate, the Pacific has such a copper coast that the big smelter will be going full blast.

"Gladiator" is the killing name of an English automobile.

HYDRATED LIME

The first cost of quick lime is a little less, but it is likely to cost more in the end than the hydrated. A few reasons why the cost is greater are: the lump



Hydrating Machine

lime is perishable, requiring careful storage and always presents the danger of spontaneous combustion. It is crude and unreliable, requires time and apparatus for slaking, and any excess used must be thrown away. Hydrated lime avoids all these objections and has many further merits. Passed through a machine, it comes out so finely divided as to produce the best quality of plaster, mortar, or cement as to strength, smoothness and density. As it shrinks less there is no cracking or blistering, and the older it is the better it gets.

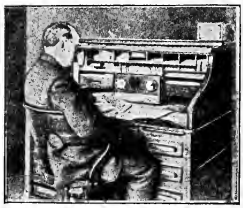
The hydrating of lime is nothing new, but it is done now with modern machinery. The ordinary lime enters the first cylinder through the hopper seen at the right of the cut, and as it is passed along by the revolving mixers it is sprayed continually by water entering through the funnel. Having passed through, it drops into the second cylinder, and so on to the bottom, where it comes out as hydrated lime. Then it is passed through a very fine screen, which takes out all impurities and delivers it as a white, dry powder ready for packing and stable in any climate.

FIVE CARS LIMIT OF FAST TRAINS

Hereafter the 18-hour trains running between New York and Chicago will consist of but five cars—a compartment observation car, two Pullmans, a diner and a combination buffet and baggage car. The Pennsylvania line started out with this limit and has adhered to it, despite the great demand for the fast service. The New York Central, however, has been handling six and even seven cars, and now the management declares it a physical impossibility to maintain the schedule with such a heavy train and has restricted the number of cars to five.

NEW TELEPHONE SYSTEM FOR OFFICES

The latest time-saving addition to business system is a little instrument which enables the head of a business or department to converse with one or all of his subordinate officers in an ordinary tone of voice, in any part of his office, and without holding the apparatus to his ear or mouth. Their replies will come to him in like fashion, so that the whole conversation will be just the same as if all parties were talking together in one room. If the manager wishes to communicate with one person only, he can easily make it impossible for anyone else to overhear, and if he wishes to keep the replies secret from someone in his own office, there is a receiver which he can use in the ordinary way.



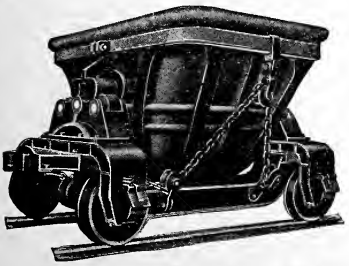
Telephoning at Ease

ROAD CUT THROUGH LAVA

Roads over lava are common enough, but cutting one through 40 ft. of lava scarcely cooled, is a different proposition. This engineering novelty comes from our new territory of Hawaii. It seems that the old government road in the Kan district has been covered by the outflow from Mauna Loa and the territorial legislature has made a beginning of reopening the road by appropriating $15,000. It bids fair to be a hot job as well as a hard one, for the cooled surface is as hard and brittle as glass, while the lower strata are still molten. But the engineers insist that it is perfectly feasible. At any rate, hot-foot will keep them stepping.

SLAG DUMPING CARS

"Cinder pot" or slag "ladle" is the name given to a metal receptacle, mounted on a car, in which the slag from a smelter is removed to the dump. They are of all sizes, shapes, and designs, each claiming special merits. One pattern, as seen in cut, consists of a round pot, swung between two trucks, and tilted sideways by means of steam or compressed air in the cylinder which is mounted on the forward truck. The special merit claimed for this style is a false bottom which can be pushed up by means of the lever and piston underneath the pot, and so dislodge any crust which has formed on the bottom.



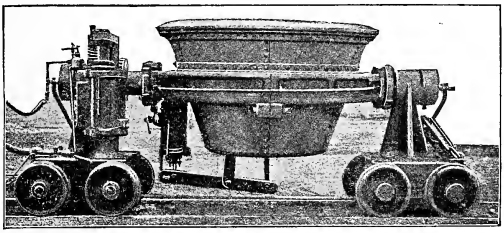
Side Dump Car

The other kind shown in cut is tipped by a draw-chain, pulled by the engine as it leaves the car. The "ladle" has a capacity of from 70 to 280 cu. ft., 210 cu. ft. being standard; it is mounted on a car body of cast steel. It may be arranged to dump either side or at the end. Simplicity, strength, and certainty of action are claimed for this style, and no linings which will need renewal.

Either of the above patterns may be connected in series, so that the whole trainload can be dumped at once, either by steam or draw-chain, from the engine.

SELF-LIFTING AIRSHIP

The "helicopter" is the high sounding name of the machine which is to outsail the aeroplane, and solve the problem of aerial flight. Two professors of Johns Hopkins are working along new lines, and the usual fine prospects of success are published. Discarding all balloon and aeroplane levitation, they propose to ascertain by experiment the utmost possibilities of "direct thrust" for lifting purposes. This direct thrust is to be furnished by propellers 40 ft. in diameter, driven by a steam engine of 100 hp. Engine, boiler, furnace and water are to weigh 1,000 lb., the rest of the apparatus 700 lb., and the inventors believe that they can generate power enough to raise this weight plus the operators. Their prime object is to get the thing to go



Side View of the Cinder Pot

straight up; after they get up they will try going sideways.

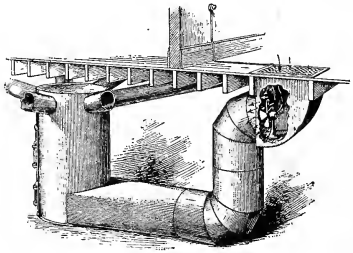
The idea of such large lifting propellers is not new, but heretofore they have been worked by man power, which proved inadequate. After they get up the professors figure that half the horsepower will be sufficient to keep them up. Here's hoping that they may get up, stay up, and when they get ready come down without any dull thud.

FORTY-FIVE MILES AN HOUR THROUGH CLOUDS

That was the experience of Alfred Leblanc, a young Parisian, who went up with a spherical balloon. A strong wind drove him and a companion through the night across France and Mecklenburg. In the morning they saw the Baltic Sea getting uncomfortably near, decided they had had enough and came down safely on the island of Rugen. They found that in 14 hours the balloon had sailed 630 miles.

ELECTRIC FAN IN HOUSE FURNACE

The new system of forcing air through a house furnace by means of an electric fan was recently described in this magazine. The illustration shows where to place the fan which is to be used only when required. The

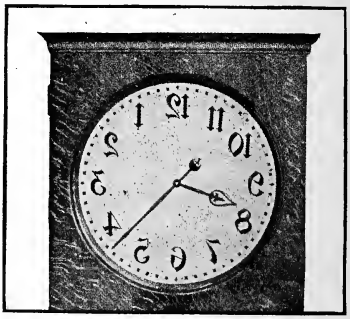


Showing Location of Fan

switch for turning on the current can be placed in the room above.

REVERSED CLOCK FOR BARBER SHOPS

Every barber shop has a clock which is invariably placed on the wall oppo-



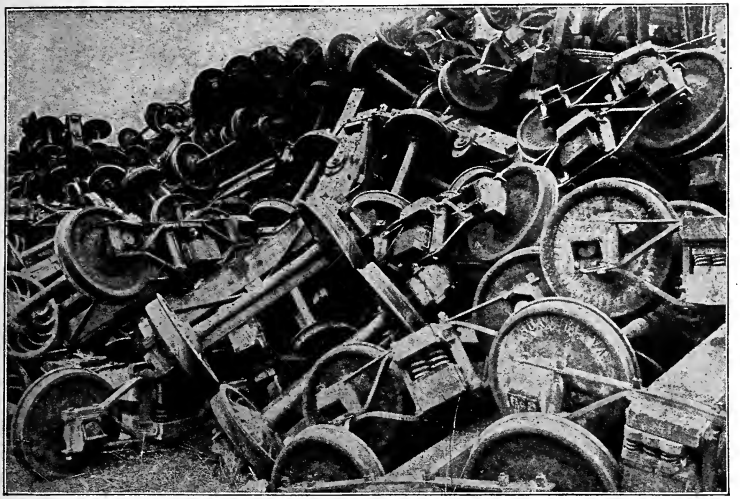
Hold Before a Mirror

site the big mirror which faces the customer in the chair. The clock face is reversed as seen in the mirror and not one man in a thousand can read the time. A jeweler in Glendine, Mont., has now invented a sane clock for barber shops. The Keystone says the figures on the dial are reversed and the hands move just opposite to those of ordinary clocks. The result is the reflection in the glass is so "you can understand it." To demonstrate, hold this page in front of a mirror and read the time of the clock in the illustration.

WIRELESS STATION ON AIRSHIP

The possibilities and practical utility of wireless telegraphy in aerial navigation will be thoroughly investigated aboard Count Zeppelin's airship this summer. A wireless station has been installed on the craft, in which, instead of extending upward as in other stations, the receiver extends downward, consisting of a bronze wire 300 ft. long. Power from the airship's two 80-hp. motors works the transmitter, which is capable of sending messages 150 miles.

BROAD GAUGE RAILROADS? NO!



This remarkable pile of wornout car wheels and old trucks contains hundreds of wheels. They were taken out from under coal cars by an Ohio railroad and will be broken up and remelted. The wooden cars to which they belonged were also destroyed and will be replaced with steel cars of much larger capacity. If all the railroads should change to 6-ft. gauge there would be hundreds of thousands of tons in similar scrap heaps from the Atlantic to the Pacific.

The most astonishing statement made by Mr. Harriman in his examination before the Interstate Commerce Commission was his remark about changing the standard gauge of our railroad tracks. He predicts the present gauge of 4 ft. 8½ in. will be increased to 6 ft. and cars made 2 ft. wider.

Every practical railroad man in the country from section foreman up to general manager knows this is a practically impossible thing. For 50 years there was experimenting with the gauge and a 3-rail track to accommodate in one train the cars of narrow and standard gauge lines was no uncommon sight as recently as 10 years ago. The narrow gauges have disappeared and the few 5-ft. roads have narrowed to standard. The best judgment of the railroad profession has decided in favor of the 4 ft. 8½ in.

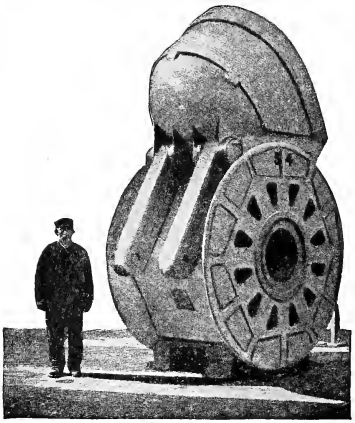
To change this standard would mean

the rebuilding of practically every mile of main line and sidings in the whole United States; roadbeds, bridges, tunnels, trestles, embankments, all would have to be enlarged. Engines, cars, depots, round houses, turn tables, switches would all be changed. Millions of dollars invested in repair and construction shop machinery would become useless. In fact, the revolution would so permeate the whole railroad fabric as to produce a physical and mental chaos.

There was a 6-ft. gauge once in this country—the Erie railway from Jersey City to Dunkirk—but as soon as it became a connecting line the folly of its gauge was remedied. What is needed is not wider tracks but more miles of present tracks and greater care in operating them.

MAMMOTH DREDGE BUCKET

The accompanying illustration is not a picture of a mammoth mortar for coast defense, but belongs to the peaceful occupation of harbor dredging. It is one of the many buckets, or scoops, which connected one to another form an endless chain of excavators. The bucket is shown resting on the drum which is submerged to the bottom, and each bucket brings up 54 cu. ft. of bottom at each trip. The "David Dale," a big dredger built for the North Eastern railway of England, specially to deepen the harbor at Hull, is equipped with these mammoth scoops.



Capacity 54 Cu. Ft.

TELEPHONE NUMBER FOR TELEGRAPH ADDRESS

Telephone subscribers in Austria-Hungary have hit upon a bright idea for reducing telegraph charges. Over there each word in the address is charged for as part of the telegraph message. To reduce this expense people register their telephone number with the telegraph company and advise their correspondents to use it instead of the name.

PRISON-MADE SIGNBOARDS

There is a poetic fitness in convicts furnishing the signboards which shall keep other people in the right road, but the superintendent of New York state prisons seems to be the first man to discover its economic fitness. He has promised to have them made in Clinton prison for use on all the state highways.

GREAT STEEL CITY BEING BUILT

An enormous steel plant producing annually nearly two and one-half million tons of steel is being constructed at Gary, Ind., and to accommodate the army of laborers that will be employed an entirely new city is being built. Parks, theaters, streets, water and sewerage systems, all will be in readiness for the people when they arrive.

In the steel plant the machinery will

be electrically driven, the gases from the blast furnaces being used as far as possible for generation of the necessary power. In the rail mill induction motors ranging in capacity from 2,000 to 6,000 hp. will drive the main rolls and a system of control which is said to be "fool-proof" will be employed.

COAL REPLACES OIL FUEL IN NEW ORLEANS

The prospect of a permanent substitution of petroleum for coal, with happy release from smoke and cinders, seems to be another iridescent dream. At least the big coal contract recently closed by the Southern Pacific R. R. and Steamship Co. is a big pointer in that direction. The contract calls for 250,000 tons from Pittsburg, to be delivered on the wharves at New Orleans.

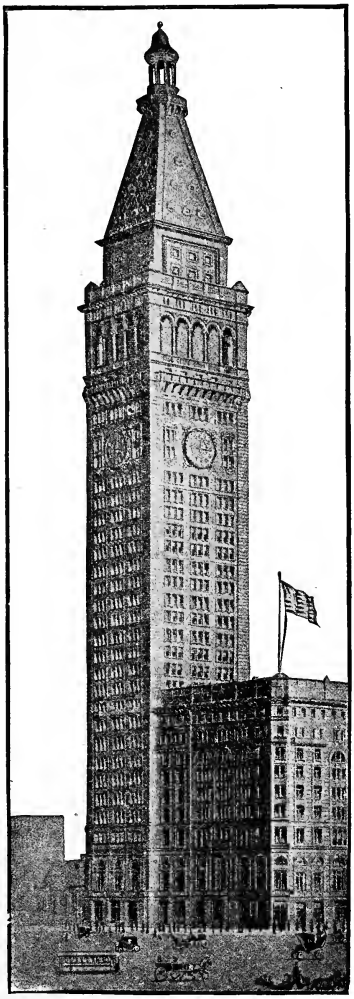
This fact is the more significant because the Southern Pacific made a strong effort to substitute oil for coal, changing its locomotives and burning large quantities of the liquid fuel. But the increase of price, due to a growing scarcity of oil, seems to have forced the railroad to abandon the project, at least in New Orleans.

BUILDING 48 STORIES HIGH

740 Feet from Base to Top

Unless somebody starts a new and bigger one before we can get this article printed the highest building in the world may be declared to be in New York City, where a tower is being added to a building in Madison Square. From the top of the building proper a tower 75 by 85 ft. will rise to a height of 492 ft. above the street, from which point it will continue in pyramid form and be surmounted by a cupola 658 ft. above the ground. The tower will be used as offices. The illustration is photographed from a model of the structure.

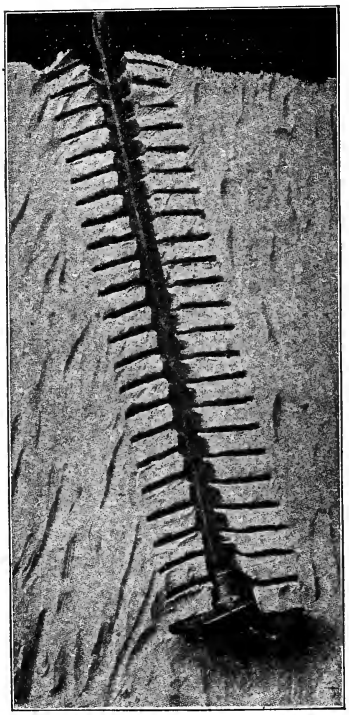
The tower will contain 8,500 tons of steel or 1,500 tons more than the Eiffel tower; the steel framework from the third sub-basement to the top being 740 ft. of continuous perpendicular bridgework. The steel columns at the base are 30 ft. long and weigh 45 tons each—3,000 lb. to the foot—and will be the heaviest ever made.



Steel Framework is 740 Ft. High

HOLDING POWER OF A GUY ANCHOR

A guy anchor for telephone poles is really a post auger which is screwed into the ground and left there. The pole is guyed or held by a small steel rope, one end of which is fastened to the pole and the other to the anchor.



The holding power is something surprising.

Tests made by Prof. Carpenter, of Cornell University, show that a 5-in. anchor, when bored into the ground 5 ft., will hold 12,000 lb.; a 6-in. anchor, 15,000 lb.; 8-in., 20,000 lb.; 10-in., 25,000 lb.; 12-in., 30,000 lb.

The cut represents a cross section of clay through which the helix of the anchor has been bored. For the sake of clearness the spiral path of the helix is left open, as if it had just passed through. The results of the tests show that the holding power of such an anchor is nearly proportional to its size.

OPENS BANK SAFE WITH SMALL HAMMER

The bank at Seward, Alaska, has a big safe with a time lock. Recently the clock stopped and all efforts to open the safe failed. Lock experts were brought from all parts of Alaska, but none were able to solve the trouble. Finally after several weeks the bank officials, in desperation, loaded the big safe on a steamer and sent it to Seattle for treatment. All this time $50,000 in currency was locked up safe and tight.

When the ship tied up at its dock a safe expert was waiting to go on board. He simply gave two or three light taps with a small hammer, the clock started and a few hours later the bolt flew back as usual.

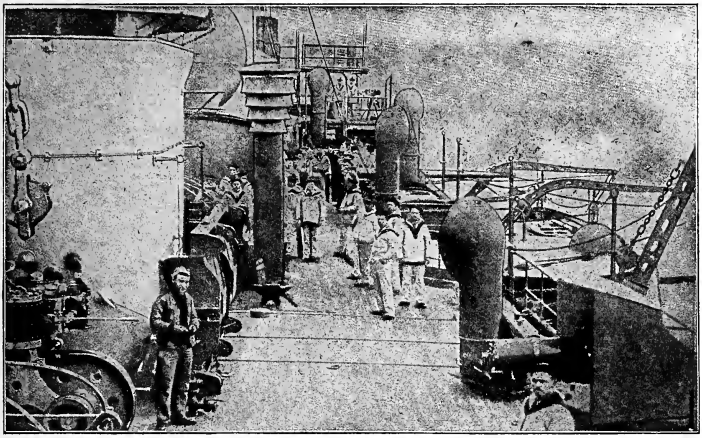
PENCIL CEDAR GETTING SCARCE

Where do all the lead-pencils come from—320,000,000 of them a year? Mostly from red cedar, which is almost indispensable for the purpose, since no substitute for it has yet been found possessing all the necessary qualities. Pencil cedar is the only wood which is always sold by the pound, and it is getting scarcer while the demand for pencils increases rapidly. Measures to increase its growth are being taken by the U. S. Forest Service, but that will take time, and meanwhile the situation becomes more acute. A fortune awaits the man who shall hit upon a satisfactory substitute. Inventors, get busy!

All the pig iron furnaces in the United States produced $400,000,000 worth in 1906, an increase of 50 per cent in four years. Of this total the Steel Corporation is to be credited with 43 per cent, or 18.6 per cent of the total output of the world.

FRENCH BATTLESHIP DESTROYED ON SHORE

Flagship "Jena" Blown to Pieces in Dry Dock—A Remarkable Disaster —Other Notable Naval Dry Docks



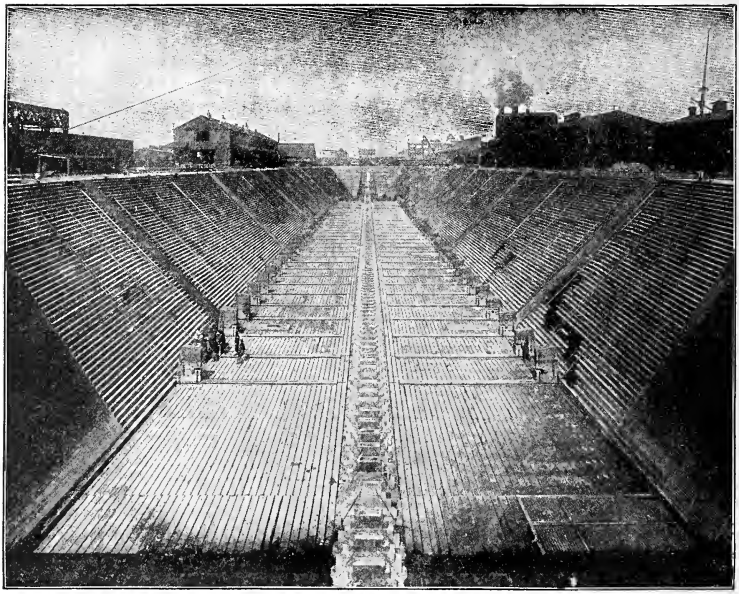
Battleship "Jena" Before the Explosion

The French battleship "Jena," flagship of the Mediterranean squadron, with a rear admiral, two captains and 630 men on board, was blown to pieces in the naval dry dock at Toulon on March 12. It was not permitted this noble ship to sink in action, go down in a storm or even founder on a rock. Taken from her ocean home, propped up with great timbers in a dry dock, and without even a drop of water to wet her sides, she was torn asunder in an explosion which killed 100 and injured 300 men.

For two weeks the work of overhauling had continued; every inch of deck and hull had been examined; every piece of machinery in gun and engine rooms had been overhauled; tons of smokeless powder, shells, torpedoes and other ammunition had been safely taken on and stored away until the magazines would hold no more. The men had finished their noonday meal and in another hour the gates would have been opened and the ship floated out into the harbor and her voyage begun. Without warning one of the after magazines supplying the 12-in. guns exploded from some cause not yet known, or at least not made public. It has even been questioned whether a spark could have been caused in the magazine by some stray current from a wireless station.

The men below were enveloped in fire and suffocated with deadly fumes, while those on deck in a wild panic jumped overboard only to meet death on the stones 60 ft. below. The other magazines could not be flooded because there was no water, and, unable to execute the orders which would have been the proper thing to do at sea, the bewildered sailors were in much the same position as a company of city firemen would be if brought aboard ship.

Owing to the flying shells it was impossible to open the gates. Those who attempted to do so were killed, and it was finally necessary to open fire



Modern Dry Dock—Water Pumped Out

on the dry dock gates with heavy guns from another vessel outside. A few well directed shots tore the barriers to pieces and the welcome waters of the bay poured in and stopped the explosions which threatened the entire city. Altogether the disaster was as unusual as it was terrible. The "Jena" was built in 1901; was a turret ship of 12,100 tons, with 16,500 hp., and a speed of 18 knots.

Largest Dock at San Francisco

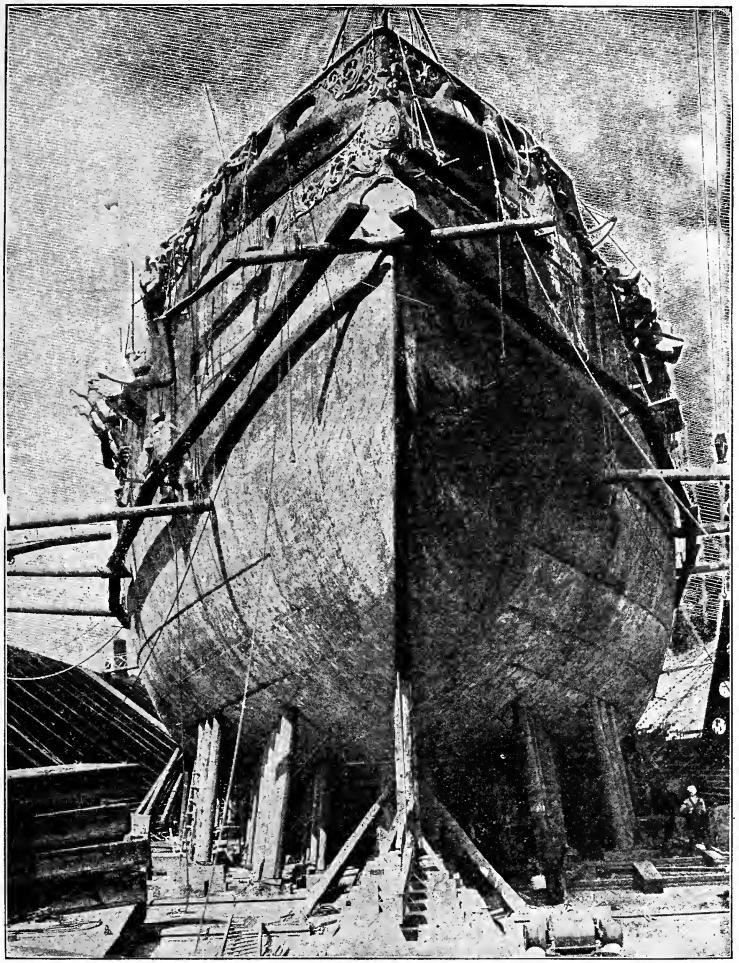
The largest dry dock in the world will now be built at Hunter's Point, San Francisco, and will exceed in capacity the present docks there, one of which is 750 ft. long, with 32.5 ft. of water. The new dock will be 1,050 ft. long, 175 ft. wide at the top and have 36.5 ft. of water over the sill. It will cost $1,250,000 and require two years to build.

It will be hewn out of solid rock and the sides and bottom of natural rock will be covered with cement.

This new dock will be able to accommodate two of the largest battleships in the American Navy at one time. The great liners like the "Dakota," "Minnesota," "Korea," "Manchuria" and "Siberia" can be docked in this gigantic basin and have over 400 ft. to spare. When the nature and magnitude of the work are considered, the cost—$1,250,000—should be regarded as a low figure. The Navy dock at New York cost the government over $1,800,000, and it is much smaller than the proposed dock.

The land has already been surveyed at Hunter's Point, and active work will be commenced and crowded forward as soon as the plans are completed.

The Secretary of the Navy recently requested the plans of the two dry docks now in use at Hunter's Point. The drawings were made and have just been forwarded to Washington. Although the company which will



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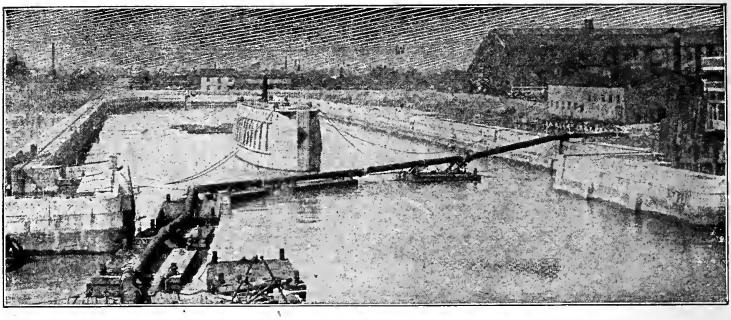
Battleship "Massachusetts" in Dry Dock—The "Jena" Was in the Same Position at the Time of the Disaster

construct, own and maintain the new dock is a private corporation, yet it is generally understood that the great work has been undertaken with the direct and active encouragement of the Navy Department; also that this department has expressed a wish to have the new dock completed at the earliest possible date.

Strict secrecy has been maintained by both the company and government agents, but the whole matter has lately leaked out and all the facts are now admitted.



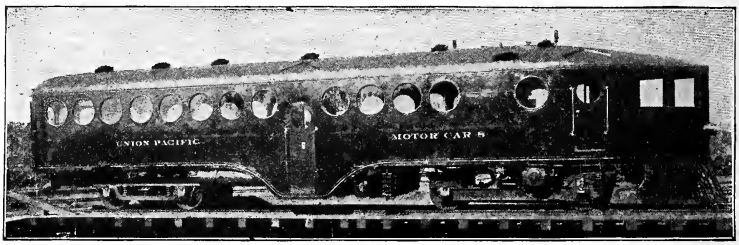
Naval Dry Dock at League Island—Nearly Completed

So great has been the increase of commerce of San Francisco that it often occurs that steamers must await their turn for their periodical cleaning, painting and repairs. However, with the completion of the new government dock at Mare Island Navy Yard, the big double floating dock to be built by the Union Iron Works, and the monster basin at Hunter's Point, there will be ample facilities to accommodate all the San Francisco shipping for years to come.

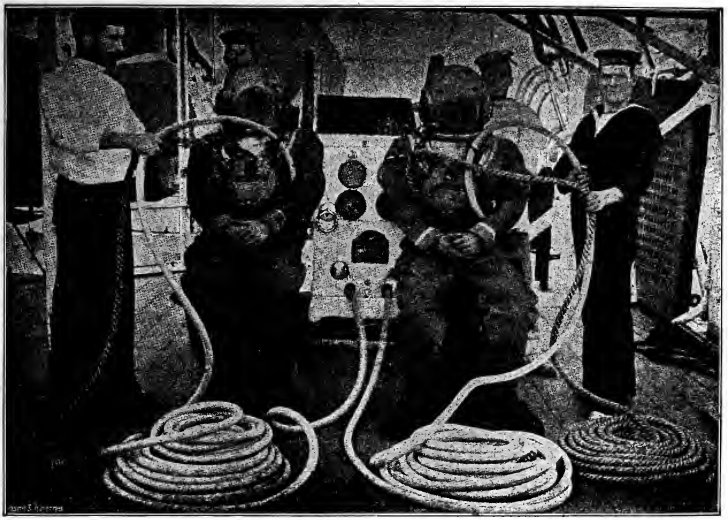
League Island Dry Dock

Naval engineers are preparing to rush to completion the new $1,800,000 dry dock at League Island, N. Y. In no other naval station in the country will there be a dock that is superior to this. The biggest ships of the line, drawing more than 27 ft. of water and of more than 16,000 tons, can be easily accommodated within the great walls of masonry. At the entrance to the dock there has been erected a costly power house. Far down under the ground, something over 35 ft., are run the giant pipes through which the dock will be filled or emptied of water. Three great centrifugal pumps, each having a capacity of 43,000 gal. of water a minute, will fill or empty the dry dock. A great fleet of warships, it is expected, will be sent to League Island for repairs when the dry dock is ready for use.

Two women made a two hours' trip in a submarine boat, recently, as the guests of J. C. Lake, father of Inventor Lake. The boat was maneuvered on the bottom at various depths up to 27 ft.



The latest of several gas motor passenger cars built by the Union Pacific at the Omaha shops. The chief change in this car is the side doors.



SUBMARINE DIVERS RECOVER TREASURE

With Lives in Peril Every Moment They Explore Sunken Ships

Lost treasure has always possessed a special fascination and has formed the basis of innumerable "thrilling" stories. But no fiction can surpass the sober facts of the history of wealth recovered from the ocean bottom, often at great depths and after long submergence. In our April issue there was a description of the wonderful perfection to which the diving-bell has been brought; here are a few of the more striking instances of the recovery of sunken treasure by English divers in closed suits.

From S. S. "Malabar" was recovered more than $1,250,000; from S. S. "Alphonso XII," $450,000; from S. S. "Hamilla Mitchell," $250,000, and from S. S. "Carnatic," $200,000. The complete list is long, but these give an idea of the enormous value of the treasures which the greedy waves have swallowed, and the inducement to invest large capital, construct ingenious and expensive machinery, and run great risks in its recovery.

The men who do this mining in deep waters, at the risk of sharks and asphyxiation, are even more heroic than the miners who face fire and "choke-damp" in the bowels of the earth. Think of working more than 180 ft. below the surface, encumbered by suit, helmet and tubing, and under the water pressure at that depth! That was done by the diver Angel Erostarbe, to secure bar silver worth $45,000 from the wreck of the steamer "Skyro" two miles off Cape Finisterre, Spain. The work was complicated by stormy weather, strong ocean currents, and the fact that the deck had collapsed within 1½ ft. of the floor of the cabin in which the silver had been stored. This made it necessary to blow away the collapsed deck with dynamite in order

[For the facts and photographs used in the preparation of this article the editor is indebted to Messrs. Siebe, Gorman & Co., Submarine Engineers to the British Admiralty and War Office.]

Ready to Descend

to reach the treasure, and this feat the diver finally accomplished with great toil and risk, and under a water pressure exceeding 76 lb. to the square inch.

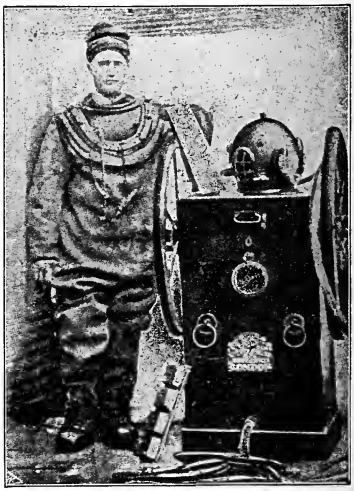
Then there was the ship "Hamilla Mitchell," sunk near Shanghai, with specie to the value of $250,000 to tempt the adventurous. After long searching on the floor of the ocean, the wreck was located in 160 ft. of water. It had been "in soak" so long that worms had bored through some of the treasure-boxes, dollars were lying around in heaps, and Diver Ridyard worked four hours consecutively at that great depth, sending up 64 boxes of precious coin.

This feat was complicated by pirates, in true story-book style. The work was being done under the shelter of an island and the men supposed that they were safe; but just as the diver came up exhausted from an effort which was without parallel, it was discovered by the merest accident that a vast flock of white sails was sweeping toward them from the mainland. Chinese pirates!

Instantly all was commocion. Exhaustion was forgotten. The diver and all hands sprang to the work of slipping anchor and chains, setting sail, and then everybody to the oars, for the breeze was light. Now both loot and life were the prizes, for Chinese pirates believe that dead men tell no tales. It was a fearfully close call, but they made it.

The recovery of boxes of gold coin worth $500,000 from the Spanish mail steamer "Alphonso XII," off Point Gando, Grand Canary, was made difficult beyond precedent by the fact that the treasure room was in the "run," or after-part of the ship, and below three decks. It took six months of the hardest kind of work to overcome all the difficulties of the situation. The depth was 160 ft., and the underwriters employed three specially selected divers for the task of locating and getting up the mine chests, each containing over $50,000 worth of yellow gold.

These tremendous depths have been exceeded, however, by Diver James Hooper, who descended to the wreck of the ship "Cape Horn," off Pichidanque, South America. The depth was 34 fathoms and every square inch of his diving suit must have been pressed



Diver Angel Erostarbe

upon by 88½ lb. So far that is the limit.

When it is considered that the greatest depth of the ocean is about 5 miles, a dive of 204 ft. seems pretty small, but it is really a great performance because of the crushing pressure of the water. The ordinary pressure of the air at sea level is 14.7 lb. on each square inch, or on the whole human body of 20,000 lb. Of course, if this pressure were not exerted equally in all directions, on the inside as well as the outside of the body, life would be impossible. Now, when a man goes under water its pressure increases rapidly, until at 35 ft. depth it is just about equal to the air pressure. As he continues to descend the pressure increases until at 100 ft. it is about 3 times the air pressure; at 140 ft., 4 times; at 170 ft., 5 times, and at 204 ft., 6 times.

To balance this tremendous pressure from without, a corresponding pressure of air within the diver's body must be carefully maintained by the air-pumping machines with which his helmet is connected by tubing. From this it is evident that only strong and courageous men can stand the strain of the diver's work, and that every precaution must be observed in both descending and ascending, especially the latter. The safe rate of ascent from depths less than 80 ft. is not more than 2 ft. in one second; for greater depths the rate must be still slower. There have been cases of divers who ascended rapidly through fright or carelessness, and on reaching the surface they exploded, the blood pouring out from the openings of the body.

These are but a few pages from the true story of these "toilers of the sea." Here the prizes for toil and danger are scarcely to be exceeded anywhere. It would be another long story merely to recount the ingenuity and capital which have been expended on the problem of locating and securing these prizes, or to name the treasures which the dark, unfathomed caves of ocean hold still out of reach of the searching hands of men.

Telephoning to Diver

GOVERNMENT WAR BALLOON

Leo Stevens, the well-known aeronaut, has just signed a contract with the War Department to furnish a big balloon and to conduct experiments with it at Fort Omaha, Neb. It will cost in the neighborhood of $12,000, and it will be capable of lifting more than a ton of ammunition.

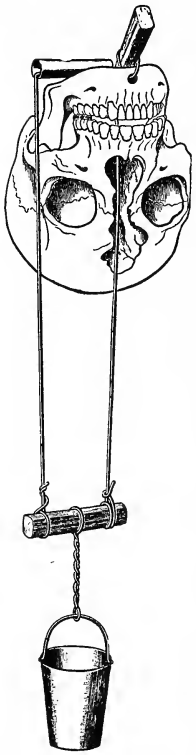
This balloon makes the tenth which the War Department owns and which are ready to be used in case of necessity. This one, however, eclipses all the others in size and capacity. It will weigh 1,700 lb. and have a capacity of 78,000 cu. ft. of gas; the netting over the bag will weigh close on to 290 lb. The bag will have a diameter of 56 ft. and the car is to be 6 ft. long, 5 ft. wide and 4½ ft. high.

A big hydrogen supply tank has been erected at Fort Omaha. The experiments will be begun under the direction of General James S. Allen, commander-in-chief of the signal corps of the army.

Although the balloon is intended mostly for signal work, it will be large enough to carry bombs and ammunition sufficient to play havoc with an enemy.

WONDERFUL STRENGTH OF HUMAN JAW

Experiments Show Surprising Force Used in Eating Ordinary Foods



Its crushing power is surprising, varying from 150 to 300 lb. It is also surprising how much jaw strength is exerted unnecessarily by many persons in eating, often with the result of cracking or breaking the teeth. They crush their food with the ferocity of wild animals. But direct pressure is a poor way of breaking up most foods, a grinding movement gives better results with much less expenditure of force.

All this has been known for a long time by physiologists, but some experiments recently made by Dr. Joseph Head, of Philadelphia, furnish exact figures on this subject which are as valuable as they are interesting. His method of conducting the experiments is made clear by the accompanying cut of a real skull. After the substance to be crushed had been placed between the teeth, weights were placed in the suspended pail until the crushing weight was obtained. These weights are given for a large list of foods, and a comparison of the figures should be a valuable guide in selecting the diet of those who are weak for any reason and need to economize their strength, also of those who chew with "store teeth."

The first experiment was made with dry crusts, which broke under 15 lb. pressure. When, however, the combined crust and soft inside were tried, even 60 lb. pressure would not go through the dense mass. When a little saliva was added a pressure of 3 lb. was amply sufficient. The deductions with regard to fresh bread and thorough mastication are obvious. People are sometimes greatly surprised at having broken a tooth when they "only bit a soft crust."

Here are a few figures taken from Dr. Head's tables. Of course, allowance is to be made for the fact that each food, and especially each kind of meat, will vary in reductibility according to quality and other conditions. Consequently these figures should be taken relatively, and not absolutely.

The weight needed to reduce corned beef, with the help of a little grinding movement, was 20 lb.; for roast beef, 20 to 35 lb. Tough "round" required 38-42 lb.; sirloin, 10-43 lb.; pork chops, 25-30 lb. The lowest on the list were boiled beef, 3 lb.; roast lamb, 4 lb.; tongue, 1-2 lb. No mention is made of hash, which would undoubtedly stand at the bottom of the list.

Dr. Black states the human jaw will exert a pressure as high even as 300 lb.

HOW TO MAKE CHEAP, PURE BAKING POWDER

Go to any first-class wholesale drug house and buy 1 lb. cream tartar and 1 lb. bicarbonate soda, the latter extra fine ground. Mix first with the second in proportion of 2 to 1 and run through ordinary flour sifter six times. Reserving a little for immediate use, seal most of the powder in a glass jar or other air-tight receptacle.

At present prices in Chicago this baking powder costs about 28 cents a pound, is absolutely pure, and consequently less is needed to do the work.

MOTOR BAGGAGE TRUCK

"What a shame to make that poor man work so hard; something should be done to the railroads." The speaker was a benevolent looking old lady who was seated in a car and watching a slim young man draw a big truck on which was loaded a dozen or more big trunks. The load was a good one for a team of horses, but the man had no assistant.

The old lady's sympathy, however, was not needed, for a closer inspection showed the man was really doing nothing more than walking along the platform and holding the truck handle. The big load followed him like a faithful dog, and when he turned to one side the truck did the same. In fact, he was not pulling at all, but only guiding the load and keeping out of its way.

"The Big Load Followed Like a Faithful Dog"

The secret of this demonstration is that the baggage truck is equipped with storage batteries and an electric motor which propels it. In the leading handle is a small switch by means of which the operator can start, stop, or reverse the truck by a mere turn of the hand.

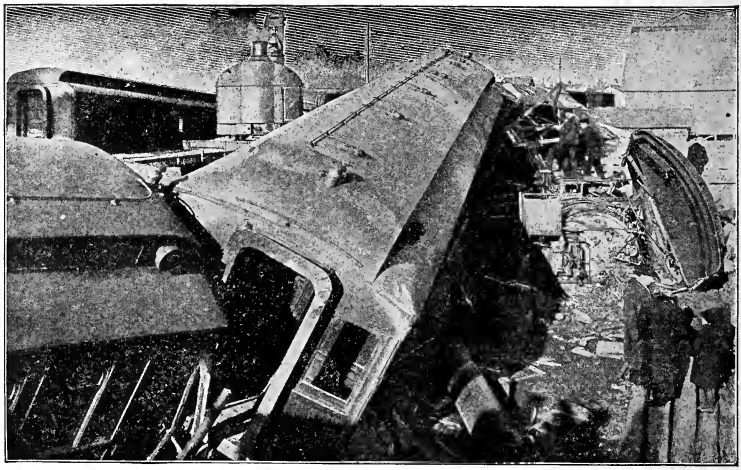
The hardest work about a passenger depot now promises to become the easiest, and bears out the prediction of an English scientist who says the human race will eventually become physically weak, by reason of having no hard muscular work to perform, as it will all be done by machinery.

U. S. BALLOON PRACTICE

About May 1st, weather permitting, four officers of the United States Signal Corps purpose to cut loose from Washington, D. C., in a free balloon. By the same permission they will sail across the country to the Mississippi valley, carrying provisions for three or four days. The main object is to give the officers practice in aerial navigation, their experience thus far having been almost confined to captive balloons.

The new one will be larger than the balloons used heretofore by the Signal Corps, and also different. It is being built in New York city, of varnished silk, and will be inflated with coal gas instead of the usual hydrogen.

COTTON THE PEACEMAKER.—The looms of the world, with millions of invested dollars and millions of men, women and children, would be idle without our cotton. Five-sixths of all the fiber produced in the world are raised in our Southern States. Cotton is the great Peace King, for so dependent are foreign nations on the cotton industry they will go far to avoid conditions which would deprive them of this great necessity.



REMARKABLE RAILROAD WRECK

In the gray dawn, while running at 60 miles an hour, the Chicago-New York flyer on the Grand Trunk railway went through an open switch and plunged into a freight train. The crash awakened the entire town of Bancroft. When the engine left the rails it tipped over and the two mail cars went on over and landed on the main line. The locomotive plowed through the dirt and came to a stop 30 ft. to the right of the track. The baggage and express cars and day coaches were mixed up as shown in the picture; the four sleepers remained on the track.

The engine crew were scalded and suffered fractured limbs, and the fifty passengers were more or less bruised, but no one was killed.

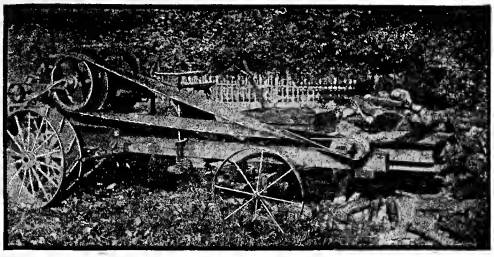
HOME-MADE TRACTION ENGINE WITH MANY USES

A self-propelled buzz saw, power plant and fire engine is what a Nebraskan experimenter produced with little else than a few harvester parts and a gas engine. The engine used was a 4-hp. stationary 4-cycle engine, which was placed on two 14-ft. timbers. The traction part was arranged by gears and a belt on the side of the machine opposite to that shown in the illustration. The traction gears are operated by a tightener on the belt which takes the place of a friction clutch. For reversing the motion the belt is removed and replaced in a crossed position. This can be done quickly and does not require an extra belt as the idler takes up the slack.

The two driving wheels are the master wheels of grain harvesters and the gearing and chain drive are from the same machines. The front axle is provided with two sulky plow wheels and the steering gear, consisting of the chains, worm gear and hand wheel, were found on the harvester. On the fore end is rigged a saw shaft and circular saw, capable of sawing a cord of wood in 30 minutes.

On the rear is a barrel containing water, which is circulated by means of a rotary pump, run by the short crossed

belt shown in the illustration. The pulley on the shaft is arranged to slide on the shaft, thus allowing it to be driven from the large pulley, if desired. When this is done the increased speed of the pump produces sufficient pressure to throw a good stream from a nozzle and is very useful for washing buggies, etc. As the alterations for running the pump can be quickly arranged, the machine would doubtless prove an excellent fire extinguisher, where plenty of supply water is available.



Combination Traction Engine, Fire Engine and Portable Power Saw

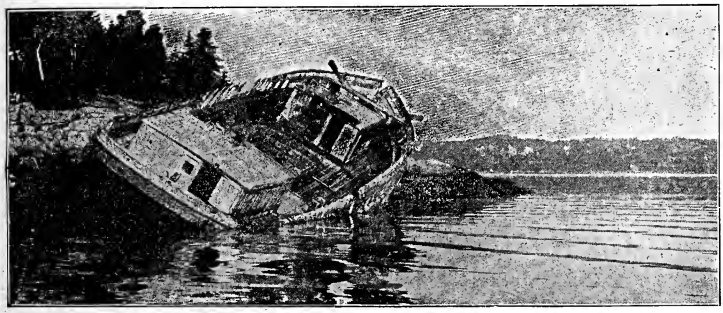
WALL-PAPER COST MILLIONS

A new design in fancy wall-paper patterns comes from Kansas City; also a way to utilize canceled checks. A firm has had all its offices papered with old checks, placed neatly edge to edge; all of the same size of paper, but not of original face value by any means. The face figures of the checks vary from $30,000 to $1,000, and the total for one room is $8,000,000. As a gilt molding runs around the edges of each check-panel, the general effect is rather pleasing.

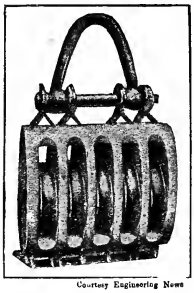
FISHING BY WIRELESS

A large fisheries company operating along the Atlantic coast keeps track of the shoals of fish by means of wireless telegraphy. The fleet comprises 40 vessels; when the coastwise steamships sight the fish they can communicate their movements to the other vessels immediately. Likewise, a part of the fleet finding fish at one point may notify the rest of the fleet and assemble the ships from remote points without delay.

Hoops on water tanks are usually too thin and unpainted, hence they often give way. They should be of wrought iron, without welds, at least ¾-in. thick, and painted inside and out. Also, keep them painted, and so avoid rusting and disaster.



QUINTUPLE WOOD BLOCKS



Courtesy Engineering News

Four of them have been finished lately for the Carnegie Steel Co., and the cut gives an idea what big fellows they are. The height over all of each block is 4 ft. 5 in., and the weight is 640 lb. The sheave pin is of rolled steel, $1\frac{3}{8}$ in. Each sheave is 15x $3\frac{1}{4}$ in., intended for a $2\frac{1}{2}$-in. manila rope.

IS "DREADNAUGHT" THE LIMIT?

Has the limit in big battleships really been reached? There are those in position to know who claim it has. Private letters from men on board the "Dreadnaught" during her recent trip to Trinidad declare the turbines worked well but that the heat in the engine room was something hitherto unknown on board any ship. The vessel also maneuvered badly at slow speed and was unable to keep its place with the other and smaller ships of the fleet.

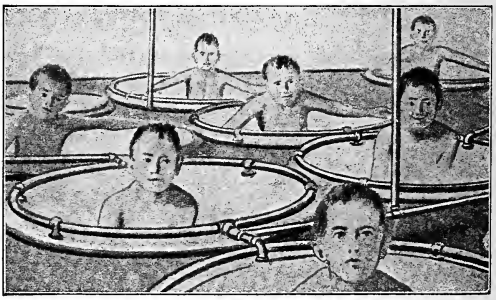
TEACH BATHING IN SCHOOLS

From Boras, Sweden, comes a novel and practical idea on the subject of giving large numbers of children separate baths at a minimum of expense and trouble. Briefly stated, a new school building in that town has been built with a bath-room containing round enameled tubs sunk in the concrete floor, each large enough for one child. A circular pipe surrounds each tub and is pierced with frequent small openings, and all these pipes are connected with both hot and cold water reservoirs. In the bottom of each tub is the outlet and stopper.

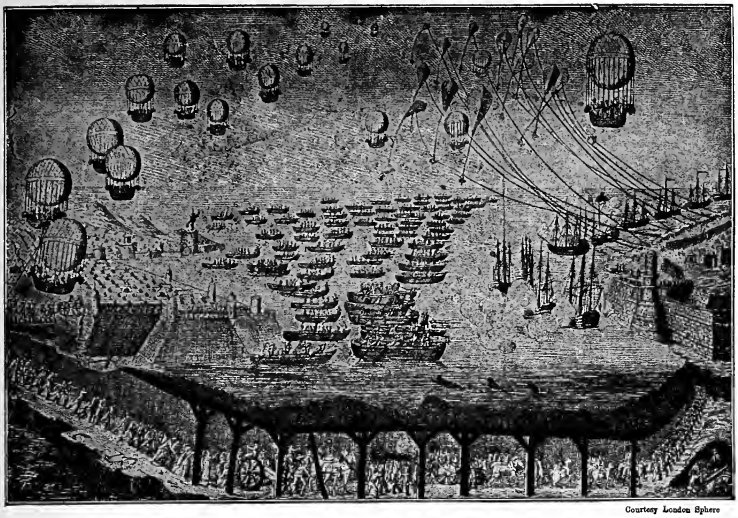
With a child in each tub, the water is turned on by an attendant until all tubs are nearly full. Each tubber is furnished with soap and brush and allowed ten minutes for scrubbing. Then the stoppers are pulled out and each child is given a final shower, beginning at 95° temperature and gradually cooling to 60°. In this way 48 children are run through in an hour. After each relay the tubs are washed out thoroughly by the jets of water from the circular rim pipes, reinforced wherever necessary by brushes in the hands of attendants, and ending with a scald of the hottest water. The tubs entirely remove the danger of drowning where large numbers use a swimming tank.

ASHES FOR FUEL FURORE

The daily papers have gone wild during a lull in the ordinary supply of news and are filling columns with the wonderful discovery (!) of a poor Pennsylvania shoemaker who "burns ashes." One teaspoonful of his secret "dope" in two gallons of water, when poured on ordinary ashes and lighted, is declared to keep a stove red hot for an hour. We recall that the Keeley motor was raised in the same state.



"Each Tubber is Allowed 10 Minutes for Scrubbing"



Courtesy London Sphere

ENGLISH CHANNEL TUNNEL DEFEATED

The construction of the submarine tunnel under the English Channel has been indefinitely postponed. Parliament listened to the war office and voted against the undertaking. This seems strange when one considers the ease with which a tunnel can be closed to an invading army, and evidently the French have no fears of an English invasion through its medium. The tunnel could be flooded in a few minutes; its entrance could be blocked by closing iron gates, or shifting a few blocks of stone into place; a few rapid-fire guns would hold back thousands; a single 1-in. pipe would carry deadly fumes sufficient to asphyxiate a regiment before it could march 100 ft. In short, no harder military accomplishment can be conceived than an invasion in these days through a tunnel from which escape is impossible and the chances of success not one in ten thousand.

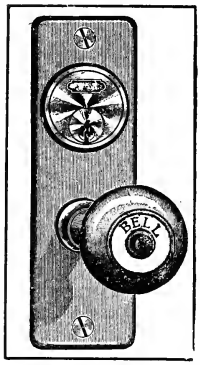
The illustration is reproduced from a French print more than a century old, and shows an invasion of armed forces by means of a tunnel. It is also interesting to note to what an extent the artist of that day recognized the future possibilities of aerial warfare. His dream of 100 years ago is just coming true in respect to air craft. Will it be another hundred before the tunnel feature also materializes?

AERIAL TORPEDO BOAT

The Peace Congress will have to hurry up and get its proposed ban on airship torpedo craft accepted by the big powers or the first conflict will witness a more deadly and dangerous fighting-machine in mid-air than the submarine has proved in naval work. The French army is already equipping with aerial torpedo boats which require only one operator and can go into action in a few hours. Each ship will carry several shells, which require no delicate machinery as the submarine torpedo, and in which practically the entire weight of the shell can be utilized for the explosive. With a few of these volcanoes on board the aeronaut has only to ascend, bring his craft overhead the enemy and let go. Gravity

and the contents of the cartridge can be depended on to make a hit every time.

BELL DOOR KNOB



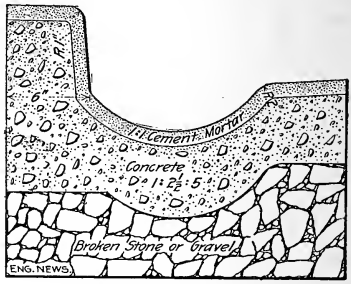
The most unique door bell yet thought out is the one with a push button in the door knob. Even in the darkest night a caller can readily locate the door knob, and, having done so, to push the button and ring the bell is an easy matter. The bell is placed in the inside knob, which is made hollow for the purpose. The device can be used on any door by removing the old knobs and substituting the new ones, which any one can do with a small screwdriver.

AUTOMOBILES IN PITTSBURG FLOOD

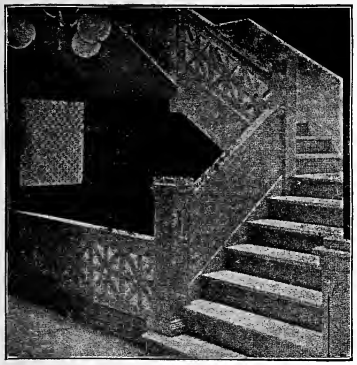
The recent Pittsburg flood in which twenty lives and millions of dollars' worth of property were lost afforded a new record for automobiles in emergencies. Makers and owners of motor cars rendered valuable service in the free transportation of people in the flooded district while stony-hearted boatmen were demanding $5 per trip. The sight of automobiles plowing through water up to the hubs was an unusual one to most of the spectators.

NEW FORM OF GUTTER

The usual street gutter is merely the angle between the curb and the slope of the pavement. Of course its capacity is very slight and any unusual rainfall floods both it and the street. To obviate this, the design illustrated has been adopted at the Jamestown exposition. The gutter segment has a 12-in. chord and a 3-in. rise, or an area of 25.2 sq. in., about equal to a 6-in. pipe.



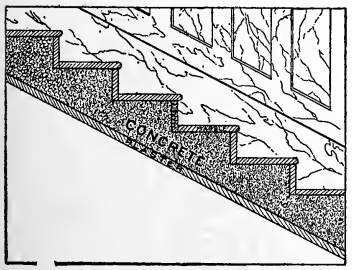
Jamestown Exposition Gutter



HANGING CONCRETE STAIRWAY

One of the most novel, useful and pleasing uses to which cement has been put in interior construction is the hanging concrete stairway. In the cut is shown a section of cement stairway which runs from the first to the third floor in a Pittsburg white marble apartment building. In its construction no structural iron whatever was used; only small channel bars ¼ in. by ¾ in. spaced about 4 in. and covered with expanded metal lathing. The false work was removed in two weeks.

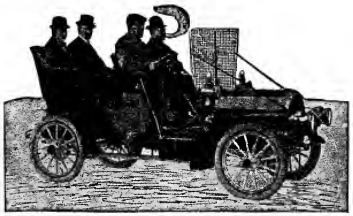
The stairway supports not only its own weight, but in addition 7,500 lb. of marble; and a load of 2,000 lb. has been carried up the stairs without injury or deflection. Only the best quality cement should be used in interior work.



Showing Construction

WIRE STORM FRONT FOR AUTO

A novel storm front has been invented by Dr. Whiting, and is described as having several advantages over the glass or mica front. The front consists of zinc mesh wire gauze attached to a wooden frame which folds up when not in use. It can be removed or put on in five minutes, and when not in use is stowed away taking up little room. The front can be set at an angle and very greatly reduces the wind resistance caused by the solid front. It has been estimated this resistance is not less than 20 lb. per sq. ft. when running against a hard wind. The gauze does not obstruct the vision and allows an agreeable amount of



Patent Applied for

Wire Gauze Protector

fresh air to pass through. In fact, under some conditions it is said the vision is more accurate than through glass.

CEMENT CISTERN FLOATS AWAY

A man in Terre Haute, Ind., has lost his cistern: It floated away in a flood. The cistern, which was built of cement, jug-shaped, had been finished but no water had been let in. A levee which kept out the Wabash river broke; the flood poured through and washed the cistern from its place.

It is now up to some notoriety seeking freak to attempt the trip through the Niagara whirlpool in a big cement jug.

A 5-ft. vein of anthracite coal just opened near Marion, Ind., is said to be equal to the finest Pennsylvania anthracite.

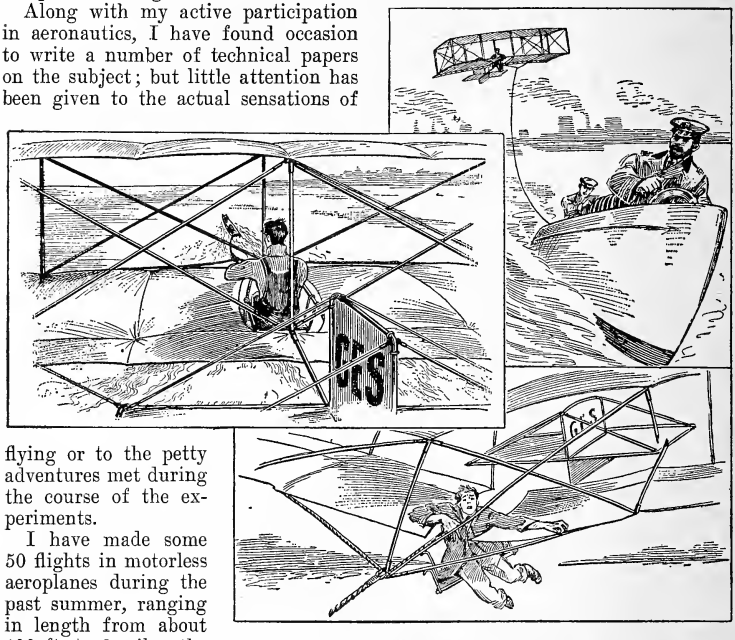
LEARNING HOW TO FLY

By L. J. Lesh

[Editor's Note—The author, who has not yet reached his 18th birthday, is a former Chicago boy, but has spent the past year in Montreal. The illustrations in this article are from his own sketches.]

Apart from the scientific interest which attaches to experiments in flying, this kind of work presents some sensational features which are of interest to the public at large.

Along with my active participation in aeronautics, I have found occasion to write a number of technical papers on the subject; but little attention has been given to the actual sensations of flying or to the petty adventures met during the course of the experiments.



I have made some 50 flights in motorless aeroplanes during the past summer, ranging in length from about 100 ft. to 6 miles, the prime object of the tests being to acquire skill and confidence while in the air. The method of experiment was to raise the machine in the manner of a kite, by pulling it through the air with a towing rope fastened to the flyer by means of a bridle. When the experiment was carried on over land, a fast horse supplied the necessary pull on the cable, and during a flight over water, a motor boat was used with good results.

Two incidents stand out in the year's work as being particularly interesting and exciting. The first of these occurred during the longest flight (6 miles), which was made over the River St. Lawrence in tow of a motor boat, and the second happened during my shortest flight (100 ft.), which was ended by a smash-up in mid-air.

The flight above the river was undertaken in hopes that the aviator would remain suspended long enough to learn something of the balance and steering of the machine as well as get over his "air-fright."

The machine rose prettily from a high concrete wharf at Montreal, Canada, and flew straight downstream for about 3 miles without any untoward incident. The aviator had just begun to congratulate himself on the performance of the flyer and to wish that the motor boat had taken on enough

gasoline to go clear to Quebec (128 miles), when he got his first taste of the dangers of the air.

One of the ropes holding the small seat with which he had equipped the machine, broke and left him hanging by one arm, with the choice of either retying the rope or negotiating a 60-ft. drop to the water. After a good deal of trouble he succeeded in fixing the seat and convincing the men in the boat that everything was all right.

This state of things did not last long, however, for a little later one of the other ropes holding the seat broke, and after some more gymnastics (physical and verbal) the aviator gave up the flight in disgust, coming down in the middle of the river about 6 miles from the start and three-fourths of a mile from the nearest land. The men in the boat (they were Frenchmen) made frantic efforts to do something after the descent, and finally succeeded in getting the aviator out of the water, unhurt, and in breaking the machine to pieces.

After this experience the writer decided to continue his experiments over land, and accordingly rebuilt the old model, making a few alterations in design and method of operation.

This machine made one flight of about 100 ft. and lasting five seconds; but into it was crowded for his special benefit all the worst sensations that one might expect to meet with during a lifetime of aerial travel.

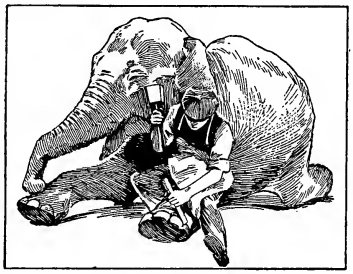
The towing power was supplied by a horse, and as there happened to be a high wind on the day of the flight, the machine rose very rapidly and plunged so violently that the aviator was unable to keep it on an even keel.

At an unfortunate moment the horse looked around to see what he was pulling, and evidently came to the conclusion that he was being pursued and had a right to look after his own interests. He bolted immediately on coming to this decision, and the increased pull was more than the light framework and wires of the aeroplane could stand.

It folded together like a jack-knife and plunged to the ground. Every stick and wire of the frame snapped, but the aviator was so fortunate as to come out of the accident unhurt. It was a tremendous bump, though, and taught him a lesson he will not forget.

MANICURING ELEPHANT'S FOOT

Accustomed to the dry climate of the Indies, the elephants imported to temperate and rainy countries are subject to many diseases of the flesh and skin to which the veterinary surgeons of national and municipal zoological gardens are compelled to give the closest watch. The smallest scratch on the sole of an elephant's foot is apt to become serious, unless immediately treated with



Trimming His Nails

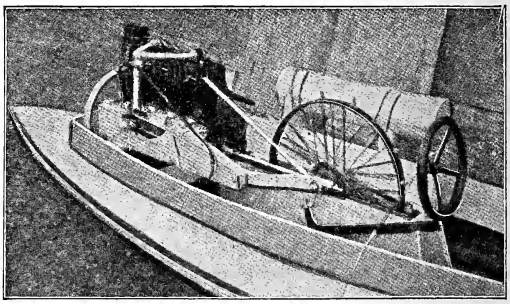
an antiseptic, and the horned substance of the feet, not being exposed to the wear produced by roaming through a wilderness, grows in captivity as rapidly as the finger nails of a human being. The illustration shows a veterinary surgeon trimming these nails or horned substances with a chisel and mallet.

BALED SNOW WITH HAY BALER

An industrious Illinois man spent his pleasure hours during the winter pressing snow into bales with an ordinary hay press and stacking the finished product in an improvised ice house for use next summer, if it can be kept that long. On account of its porosity, however, baled snow is far from being equal to good ice.

ICE MOTOR SCOOTER, NEW SPORT

Winter sportsmen are already getting ready for next year, and are impatiently waiting to engage in the new and furiously fast sport of racing their motor scooters on ice. The motor scooter is a new kind of craft and only one has been built, but its performance the past winter has set a lot of people crazy to possess them, for 100 miles an hour is declared easy, and nobody knows yet what the limit will be. The sailing iceboat, generally considered pretty swift on the wing, must now go out of business and join the canal boat class.



Motor Scooter Swifter Than an Ice Yacht

The motor scooter is the invention of Nathaniel Roe, "who took an ordinary 14-ft. scooter with sharp prow and rounded stern," says the Automobile, and fitted it with a 20-hp. gasoline engine. The driving wheel has sharp steel spikes and reaches the ice through a casing like a centerboard. Hence if the boat runs into open water or breaks through the ice, no water can enter. Two sharp steel blades at the stern serve as rudders, worked by an automobile steering wheel. The craft also makes excellent time over hard snow and by putting a pair of wheels under it forward and aft, can be towed by a horse or motor car, about the country.

BIG WOODEN FLYWHEEL

After an accident to a flywheel in a large European electric station the superintendent designed and had constructed a flywheel of wood which has a diameter of over 35 ft., and a rim width of 10 ft. The thickness of the rim is about 12 in., and it is made up of 44 thicknesses of beech planks, says Power, with staggered joints. The boards were glued together and then bolted. The inside consists of a double wheel, the 24 spokes of which are fastened to two hubs. Spokes and hubs are of cast iron. The wheel is operated at 76 revolutions per minute, which corresponds to a peripheral speed at the rim of 130 ft. per second (94 miles per hour). This is said to constitute a record for wooden flywheels.

NO AMERICAN MERCHANTMEN IN THE ORIENT

American vessels are never seen in Indian and other Eastern ports. Other nations, even small ones like Belgium, send their own ships to these countries and consequently reap the abundant commercial profits, while United States manufacturers are not able to compete with them.

A commercial agent representing American firms and who has had years of experience in the Orient, declares that he has not known of an American vessel being in any Indian port for years. American products are shipped to England and from there reshipped aboard British merchantmen to India. Consequently Great Britain does 90% of the foreign business with India.

Post cards to be admissible to the mails must conform in weight and size to those printed by the government, may not be folded, and the use of glass tinsel, mica, or metal is forbidden unless the card be enclosed in an envelope.

LARGE CHURCH BUILT FROM ONE TREE

Built From One Tree, the Age of Which Was Estimated to Have Been Nearly 2,000 Years

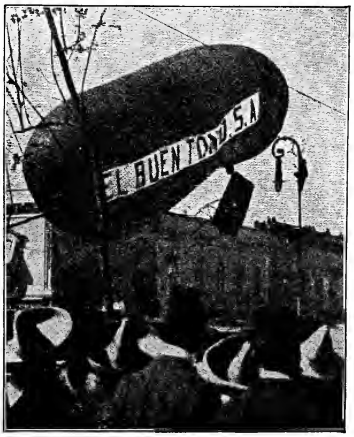
All the lumber, even to the shingle roof, used in the construction of a large church at Santa Rosa, Cal., was furnished by a single redwood tree. The main building of the church is 40 ft. by 80 ft., with ceiling 22 ft. in the clear; spire, 90 ft. high. There is an audience room large enough to seat 400 persons; parlor, seating 90; pastor's study, vestibule and toilet, and yet when the edifice was completed not all the material from the ancient redwood had been used. The tree was grown in Mendocino county, California, and when felled its age was estimated by scientists to be nearly 2,000 years.

METALS HAVE ODORS

A German scientist declares that every metal has its characteristic odor. Not every one can detect the odor of cold tin, copper or aluminum, but when pieces of such metals are heated to a moderate degree, they give off strong smells, distinguishable by anybody. At higher temperatures metals lose all trace of smell, but again give off an odor on being heated after a lapse of several hours in a cold state.

PECULIAR AIRSHIP ACCIDENT

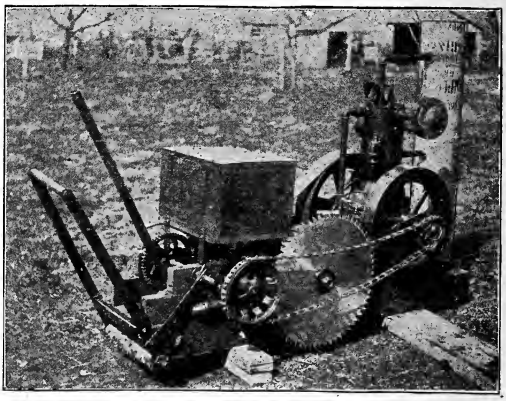
An American inventor living in the City of Mexico has amused himself and astonished the natives the past three months by sailing about the town in an airship. When making an ascension recently he accidentally steered into a tall electric light pole, and there he stuck. As usual a great crowd congregated, blocking the streets. In trying to release the ship the gas bag was torn and the craft slowly settled to the street. A photograph was taken which shows the airship as it has begun to descend.



SELF-PROPELLED MOTOR ICE-CUTTER

The horse-drawn and hand-pushed ice plow which has been used for years in harvesting natural ice has a new competitor now in a motor machine.

The illustration makes its operation readily understood. A gas engine is mounted on a skid, driving a circular saw on each side and cutting two strips of ice, each the width of a cake, at each trip. The machine is steered by a handle very much as a lawn mower is guided, only in this case the outfit is self-propelling. At the rear end, projecting from the frame, is a roller full of sharp steel spikes. The roller is turned by means of a sprocket chain driven by the engine, and is thrown in and out of action by the long lever in front of the handle. It is said that with this machine more ice can be cut than in any other way, and that the cuts are smooth, enabling the packing of the ice in the house to better advantage.



Steered Like a Lawn Mower

SCHOOL OF RAILROAD SHOP WORK

The Missouri Pacific has followed the example of the Baldwin Locomotive Works and opened a school for its shop apprentices. The boys report in squads of five each for 30 minutes each day, the instruction includes mechanical drawing and mathematics. Two instructors with university training do the teaching, and the taking of correspondence school courses is encouraged.

The more volatile oils usually require a higher ignition temperature than those which do not vaporize so easily.

OXYGEN MADE AT HOME

Will Keep Milk Fresh for Several Weeks

An English firm has put on the market a chemical in cakes like soap, which when placed in a small steel tank generates pure oxygen in a few moments by the simple addition of water. One pound of the cakes will make 3 cu. ft. of pure oxygen. The apparatus is 18 in. high, 5 in. in diameter, weighs 6 lb. and can be carried in the hand. The gas is suitable for any of the numerous purposes for which oxygen is now used, such as disinfecting, for divers, miners and aeronauts, and for the crew in submarines. Where large quantities are required larger generators are supplied. A small generator costs $6 and the cakes about 35 cents per pound. The process is without danger.

Oxygen has been used with great success for preserving and sterilizing milk which is bottled immediately

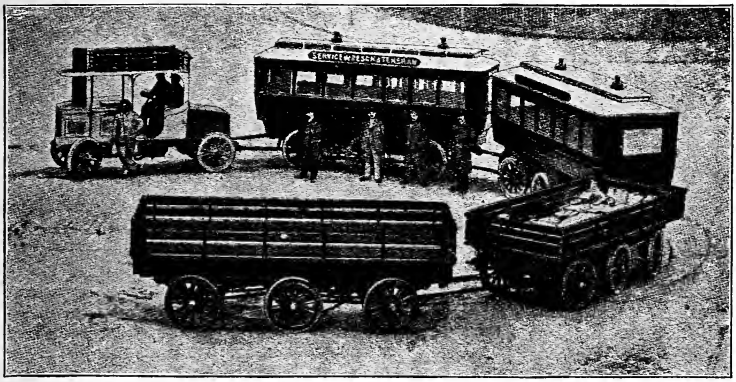
after milking, under a pressure of oxygen. A light heat is applied for a few seconds in the presence of the oxygen under pressure, and suffices to destroy the microbes and any harmful fermenting matter, without boiling the milk, which will remain fresh for several weeks and preserve its good taste as well as all the other nutritive qualities of fresh milk.

A life-saving box for resuscitating the apparently drowned and asphyxiated is also available, costing, complete, about $6. It is in use at many mines and blast furnaces and can be put in operation in two or three minutes. The gas is conducted through a "wash bottle" or purifier and thence into a rubber bag shown folded in the lid of the box. One charge will produce a cubic foot of pure oxygen in 10 minutes; the normal dose is one-ninth of a cubic foot in all cases of asphyxia.

The long-distance overland record for wireless was made March 10 when the Government station at Point Loma, Cal., caught a wireless passing between Washington and Pensacola, Fla. The same station also caught a message from the battleship "Connecticut," which was communicating from New York Harbor with Washington.

TRACKLESS TRAINS FOR RURAL DISTRICTS

The next 10 years will witness as great a revolution in rural transportation of farm produce, as the rural free delivery and rural telephone have made in the domestic comfort of the farmer's home. Every fairly prosperous farmer will be president of his own line, while serving as conductor, engineer and general manager, and can issue annual passes to his neighbors—if the state legislature does not forbid. Incidentally the farm 10 miles from a railroad station will be worth as much as the ones nearer town. When the farmer once comes to realize his possibilities the good roads business will take care of itself.



Any Farmer Can Couple on His "Car" or Wagon

Our illustration shows a wagon train, the invention of one Renard, a Frenchman. The cars and wagons have each six wheels, the front and rear pair of each vehicle arranged to turn like the front pair on a buggy. The vehicles are not only coupled together but sections of shafting extend through each connecting to the motor car, and by gearing to the wheels of all the others. By this arrangement each car supplies its own necessary tractive weight and the "locomotive" need not be heavy.

MACHINE THAT READS CHARACTER

This machine scientifically measures, delineates, prints and delivers on a sheet of paper, the approximate degree of development of every faculty of the brain. Its operation may well be compared to the working system of a large newspaper. The many radiating pins or rods which come in contact with the subject's head are like so many distant reporters, who telegraph the exact dimensions of the faculties, or "bumps," to the editor's office in the cabinet, the messages being carried by 140 wires contained in the metal tube supporting the head piece.

The editorial department, consisting of an electromagnet, controls the movements of a typed wheel, similar to the typed wheels in automatic weighing machines, thus causing it to perform the function of a compositor. The printing department then comes along with a piece of blank paper, takes an impression from the typed wheels, and passes the copy to a newsboy lever, which seizes the impression and delivers it to the reader. A printed list of vocations, which accompanies each impression, enables the subject to determine to a certain extent the trade or profession to which he is best adapted.

Measuring the Mind

Of course this machine is not infallible as the interpretations depend on phrenology, which in itself is not infallible; but it will produce in a few seconds as intelligent and complete a record as could be produced by an expert phrenologer in half an hour and if phrenology were reduced to an exact science the machine would probably do the rest.

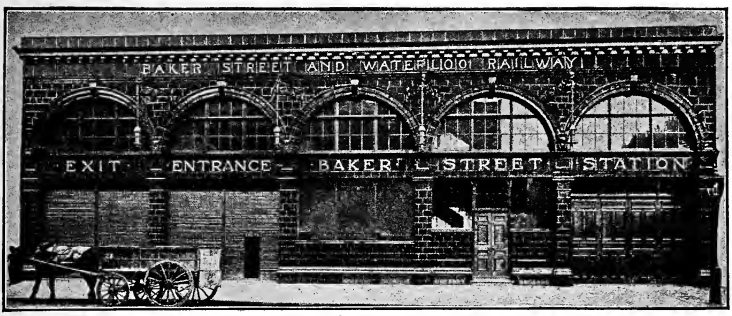
Although the construction of this machine appears somewhat complicated, owing to the great number of parts, the working principle is very simple. All the little rods or reporters are provided with contacts, which slide on rows of insulated metal points. There are five points in each row and each point has electrical connection with the magnet in the cabinet. A fully developed faculty or "bump" will thus push the contact on the rod all the way out to the fifth point, thereby making contact with that point and causing the typed wheel to register five points for the corresponding faculty, while an underdeveloped faculty will only push the contact out one or two points, thus registering that number of points on the record.

SPECIAL DELIVERY WITH ROCKETS

The most unique method of delivering mail doubtless is that employed by steamers passing the islands of the Tonga group in the Pacific. On account of many reefs, landing is extremely dangerous, and the few letters to be delivered are attached to large skyrockets which are fired and reach the shore in safety.

GLASS PARLOR UNDER SEA

A tower resting on the bottom of the ocean 30 ft. below the surface and extending up into the open air will be built at Long Beach, Cal. The shaft will be constructed almost entirely of heavy plate glass with a glass room 12 ft. square at the bottom reached by an elevator. This will give visitors an opportunity to observe the wonderful sea gardens for which these waters are celebrated.



LONDON'S SUBTERRANEAN THOROUGHFARE

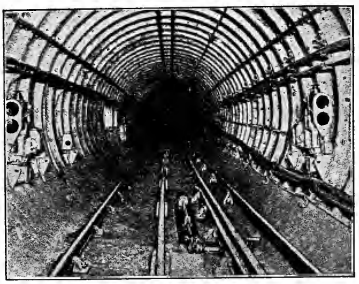
Subway Under Subway—Over 258,000,000 Persons Carried Annually—Safer Than Streets

Most of the large cities of the world have turned to underground transit as the solution of congested street and transportation difficulties, elevated structures having been found unsatisfactory. London, with nearly seven millions of inhabitants, long ago availed herself of this recourse, but the old two-penny tubes, operated by steam power and so poorly ventilated that they were a menace to health, are scarcely to be compared to the model, electrically-operated and carefully safeguarded lines that now underlie her streets, sometimes more than a hundred feet below and again following so near the surface that a persevering child might dig through the three feet of soil and touch the top of one of the big steel tubes.

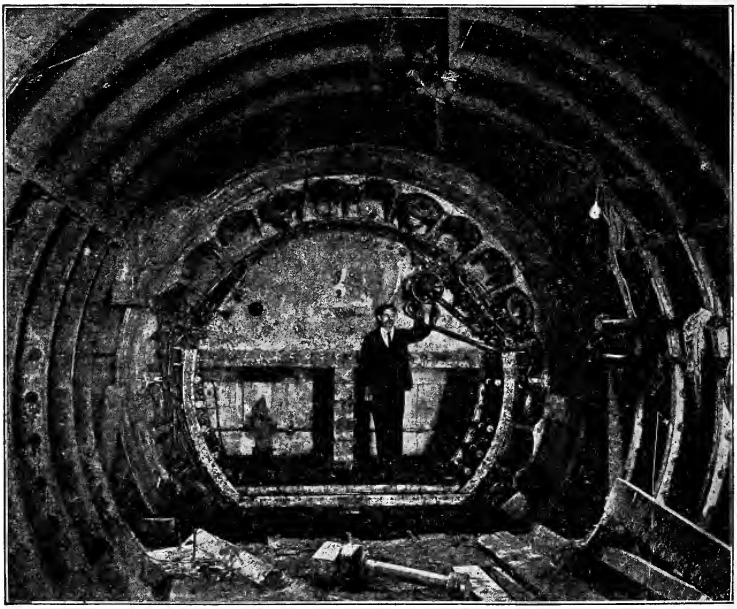
In all, London has six underground electric railways completed and five more are under construction and projected; and of the 600,000,000 persons carried annually on all her railways, 258,000,000 are accommodated by these tunnel lines. The main system was planned by the late C. T. Yerkes and included electrically equipping the old Metropolitan District Railways and the construction of four other great intersecting lines, covering a total route length of 74½ miles. The greater part of this enormous undertaking has already been accomplished. The old District lines have been transformed and two of the new lines are in operation.

The Baker Street and Waterloo Railway, 5¼ miles in length, is a fair type of all the others. The route was formerly covered by omnibuses, about 158,000 passengers being carried daily. The underground line accommodates 35,000,000 passengers annually, and at a rate of 14 miles per hour trains cover the entire route in 22 minutes.

Approaching the Baker street station we are pleased with the handsome effect produced by the dark but brilliant



Signals and Automatic Stop in Tunnel



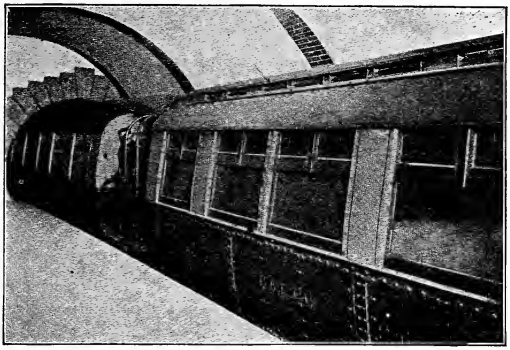
The Greathead Shield Making the Bore

red terra cotta glazed blocks built up over the strong steel framework. The roof has been left flat. Possibly these Londoners expect to build upward some time as well as downward. The entrance is wide and roomy, and the people are moving leisurely. Having passed through the spacious booking halls and bought our tickets at 2d. (5 cents) apiece, we come upon the elevators or lifts. There are two shafts with two lifts each, of the winding-drum type. Did you notice as we came through that the station buildings are fireproof? Even the joinery of the windows and doors! The only wood used is of teak, which is almost fireproof. And look at this lift! All of steel, with a non-inflammable wood floor. Holds as many as 60 people. The passengers leave at the opposite side from that at which they enter. Saves time, and the attendant does not have to push through the crowd to get to the exit gate, as it is operated automatically by compressed air. The operator can instantly stop this car at any point, or should it attain undue speed it will be stopped automatically by apparatus in the winding room. If necessary the lift can also be worked by an attendant in the winding chamber through the control apparatus there. Makes one feel pretty secure, doesn't it?

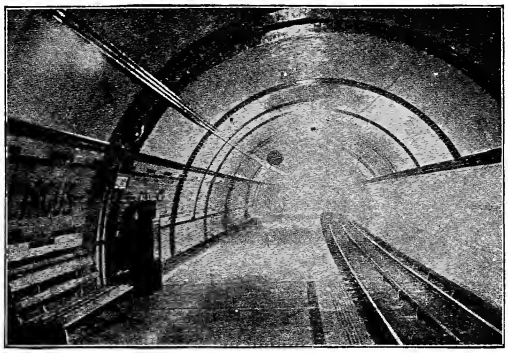
Whew! Feel that draught? Would not expect it down here, would you? It's from the ventilating fans. There's a staircase for emergencies, you know. It's in a shaft 18 ft. in diameter and winds around an iron tube 4 ft. 6 in. wide. A fan 5 ft. 6 in. in diameter is placed in the upper part of the station near the top of the air shaft and is driven by a 10-hp. motor. The air shaft passes under the station platform and terminates in a large cowl erected at one end of the platform, where the

air is sucked in through open wirework. The fan extracts from 18,000 to 20,000 cu. ft. of air per minute, while fresh air enters by the staircase and lift shafts. They say the whole air in the tunnels can be changed once in an hour. Rather an improvement over the first two-penny tube!

Light as day down here, isn't it? This concrete platform is 400 ft. long. Nice effect, those cream-colored enameled tile walls and that white painted arch. The tunnels at all the 12 stations on this line are over 21 ft. in diameter. There comes a train; they run three minutes apart. Six all-steel cars—a motor at each end and four trailer cars between—all 50 ft. long, 8 ft. 8 in. wide and 9 ft. 5⅜ in. high from rail level. The trailers each seat 52 passengers and the motors only 46 each, the remaining space being taken up by the driver's cab, built of steel and containing all the control apparatus, as well as the air compressors.



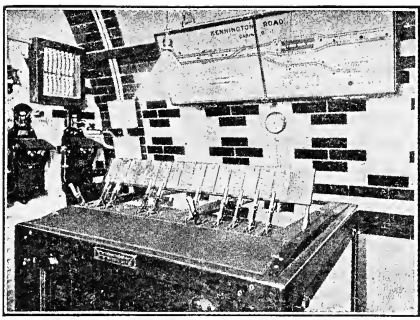
"Here We Go Into the Bowels of the Earth"



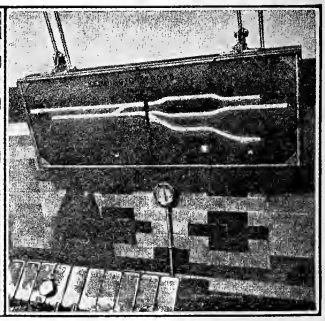
"These Concrete Station Platforms Are 400 Ft. Long"

Here we go into the bowels of the earth. It is much like all the rest in construction. Each track in a separate circular tunnel lined throughout with cast-iron segments bolted together. The steepest incline on this line is 1 in 60, and the radius of the sharpest curve is 330 ft. Three diameters of running tunnels are used, 11 ft. 8½ in., 12 ft. and 12 ft. 6 in., the largest for the sharpest curves. Never guess we were down so deep; averages between 60 and 70 ft., though. Over in the new Great Northern, Picadilly and Brompton Underground at one point the level is 123 ft., while at another not far distant it is but 20 ft. Much quieter here than one might expect. That's due to the quarter-inch felt pads used on the tracks between the chairs and the sleepers, and the fiber insulators put round the necks of the bolts that hold the chairs down. These pads, together with the elastic roadbed, have also eliminated the vibration trouble that has sometimes annoyed residents near underground railways.

Twenty electric glow lamps in this car. They are arranged on four circuits. When the train crosses a gap



Signal Box at Kennington Road



Signal Board, Illuminated

in the conductor rails wider than the span of the front or rear shoes of the car only half the lights in the car will go out. The headlights are entirely independent of these. Those 16-cp. lights placed in the tunnel at distances of about 40 ft. give a good light and being so high up, there are no disagreeable flashes. There's a splendid signaling system on this line; block sections, automatic train stops and all that sort of thing; the driver can establish telephonic communication at any point, also.

The big Chelsea power station, the largest in the country, is the heart of it all, however, pumping its power like life-blood along a network of great arteries and small arteries and tiny capillaries. Never visited it? There are 64 boilers, each evaporating 18,000 lb. of water per hour. Chain grate mechanical stokers, superheaters, economizers, all the modern apparatus are installed. In the engine room are eight turbo-generators of 7,500 hp. each, a total of 60,000 hp. The steam turbines run at 1,000 r. p. m. and each is coupled to a 5,500 k..w., three phase, alternating current generator. The pressure generated is 11,000 volts and the frequency $33\frac{1}{3}$ cycles per second. This line alone requires considerable energy to keep it going. There are the high tension feeder cables running along the tunnels to the sub-stations, the conductor rails, two to each track, which supply the current for working the trains; the 220-volt three-phase circuits supplying the incandescent lamps in the tunnels; the 550-volt circuits for the lifts and the arc lights in the stations; the entire system of telephone circuits, the electrically continuous track rail in each tunnel for the signaling system, the negative main for the same purpose, and besides a compressed air pipe running from end to end of the railway and supplying air to the pneumatic motors, for the signals and switches.

That new tramway-subway built by the London County Council is quite an experiment. Runs close to the surface, you know. The top is only 3 ft. down at one point, and at another point crosses another subway running far below. They expect to build more of them. Wonderful, isn't it!

Let's get off here at the Embankment station and transfer to the Charing Cross station of the District Railway. Oh, no, it is not necessary to ascend to the surface—this is an underground transfer.

The gunboat "Wasp" cruised up the Mississippi river lately, stopping at all important ports to secure recruits for the Navy.

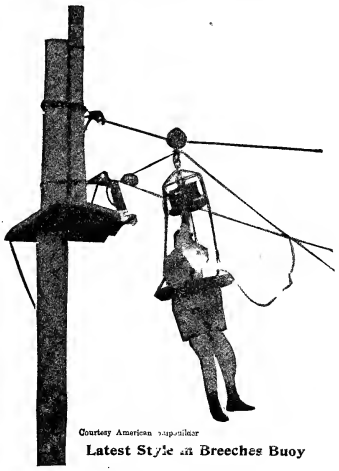
It would have cost $700,000,000 to pay hand labor for the work done last year by farm machinery.

ELECTRIC LIGHTED BREECHES BUOY

First Improvement in 100 Years

Few people are aware that the breeches buoy employed by all life-saving stations the world over has been in use for 100 years; and no less surprising is the fact that until now no improvement in its construction has been made in all that time. When the lifeboat cannot go out, a light line is shot from a cannon on shore over the wreck, where it is seized by the sailors who use it to draw out a heavier line which is made fast to the ship. On this line the breeches buoy is drawn back and forth with a light line, the outfit being suspended from a trolley which travels on the big rope. The buoy consists of a cork round life preserver to which is attached short breeches of stout canvas—hence the name. One passenger can be taken at each trip. Inasmuch as rescues with this apparatus are most often made at night, great difficulty is experienced by the crew on shore in knowing when the buoy has reached the ship, or is loaded ready to return; and frequently passengers are nearly drowned in the waves by being stopped after getting a few yards from the ship. Even when the men on shore keep pulling, the occupant is tossed up, his head striking against the heavy iron trolley.

The new device has an air cushion to protect the head, and a box containing an electric battery which will burn for 24 hours. Water or wind has no effect whatever upon the lights, which are the important improvement making signals possible for the first time. There are three bull's-eye lights; a white one shining down on the breeches buoy, a green light burns on the sea side, and a white light shows on the shore side so long as the buoy is empty. The moment a person gets into the breeches the light automatically changes to red, which is the signal to "haul away."



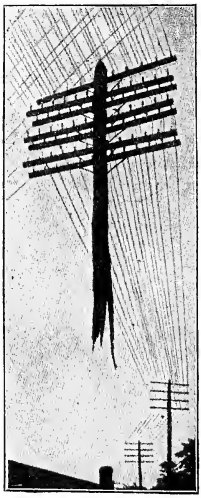
Courtesy American Lighthouse

Latest Style in Breeches Buoy

The apparatus which has been tested with great success, is the invention of a Captain Dalton, of Cape Cod, an expert in life-saving work, and is the result of a wreck two years ago in which every person on board the ship was lost. It has been adopted by the U. S. Life-Saving Service.

STRENGTH OF TELEPHONE WIRES

In switching some freight cars on to a siding at North Haven, Conn., the brakes failed to work and a car ran off the end of the track and crashed through a big 50-ft. telephone pole, breaking it at the ground and at a point 25 ft. high. For a few moments that part of the pole left swinging in the air danced up and down like the bobber on a fish line, and threatened to bring down the line. The wires however proved equal to the strain and for several days the unusual sight was a curiosity to hundreds of people. After breaking the pole the car went on and stopped right in front of a house, which would surely have been wrecked but for the fortunate location of the pole. The owner now thinks telephone poles good things to have around a man's house. The picture is reproduced by courtesy of the American Telephone Journal, from a photograph made by John Putnam.



"Swinging in Mid-Air"

ATLANTIC OCEAN TRAFFIC

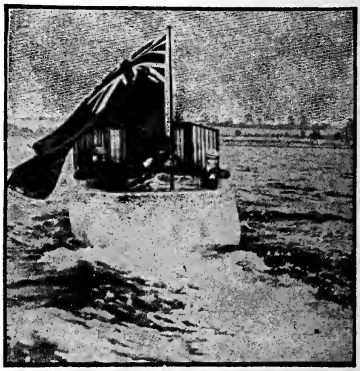
During 1906, there were 1,097 landings of trans-Atlantic liners at New York, bringing to this side a total of 1,159,551 passengers, and for the first time exceeding the million mark. Of these passengers 218,720 were cabin and 940,831 steerage. The latter figures are especially noteworthy in view of the now stringent immigration laws, and absence of rate cutting on the Atlantic.

There were 15 steamship lines whose vessels averaged over 1,000 passengers per trip west during the entire year, while certain favorite lines averaged over 2,000 passengers per boat per trip.

LIPTON'S NEW 50-HP. MOTOR BOAT

Sir Thomas Lipton has just received from the builders, White Bros. of Southampton, England, a new motor boat, which he has named "Britannia 1." She is 50 hp. and has a speed of 14 knots which can be maintained in the roughest weather or any kind of a heavy sea. She is 55 ft. long and has two 6-cylinder 50 hp. motors, turning twin screws. The motors are built by the Britannia Engineering Company, of Colchester, who designed the above arrangement to eliminate all vibration. Sir Thomas' new boat is probably the smoothest running motor boat yet built for one not equipped with electric power.

The saloon is a handsomely furnished apartment, with ceiling high enough for the tall owner to move about without stooping. Pantry,



"Britannia No. 1"—50 Hp.

kitchen and lavatory are located near the saloon. Under the forward deck, in the engine room are two folding beds for the engineer and assistant.

PUSH BUTTON OPERATES MORRIS CHAIR

The latest ease producer is a Morris chair which tilts backward or forward

No Exertion to Operate

as much or little as desired without getting up to set the rod. In fact there is no rod, but instead a series of stops controlled by a push button. You simply touch the button and the weight of the body carries the back to any angle wanted; sit up straight and touch the button again and the chair straightens up at the same instant.

LEARN SPANISH; NOT GREEK

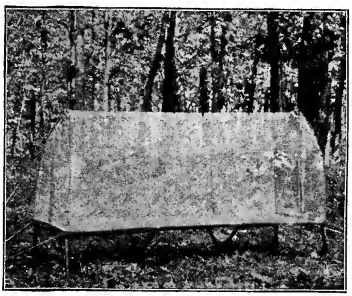
Spanish is the language of commerce in the Western Hemisphere, hence a young man had far better learn Spanish than Greek, unless he intends to devote his life to study, in which event he would master both.

The commercial possibilities of the immediate future with the Latin speaking countries which are just coming as purchasers into the markets of the world, are beyond compute. Spanish is the most useful foreign language a young American can learn. Not only is it essential to a traveling representative or resident agent in the Latin-American countries, but there is a great demand at home for stenographers, correspondents, and export department clerks and managers, each of whom are able to command very much larger salaries by reason of their knowledge of Spanish, than is paid to corresponding positions in the same establishments to their English speaking and writing employes.

The Latin countries will be slow to change either their custom or language, and if we are to do business with them we must learn their language; not wait for them to learn ours.

SPORTSMAN'S PORTABLE BED

A bed 6 ft. long and 28 in. wide, made of canvas and collapsible metal frames, and weighing only 6 lb. is now available for campers. The entire outfit folds into a package only 14 in. long, which can be packed in a trunk



Shuts out Insects and Rain

or slung over the shoulder. The bed proper does not touch the ground, and a light wire frame supports mosquito netting, which shuts out all insects, or in event of cold or rain a blanket or canvas may be used as a roof. The bed can be set up or taken down in a few minutes.

A clearing house to look after the 2,000,000 freight cars of leading roads will be established at Chicago.

RAILROAD HAS 72 PER CENT GRADE

Incline Plane Railway—Capacity 25 Tons

At Weehawken, New Jersey, there is one of the queerest railways ever built. It is a 300-ft. incline with a grade of 72 per cent. Cars 20 ft. wide and 40 ft. long capable of carrying a load of 50,000 lb. are used on the line. These cars are operated by 300-hp. electric motors and make the ascent in one minute. Both passengers and vehicles are carried.

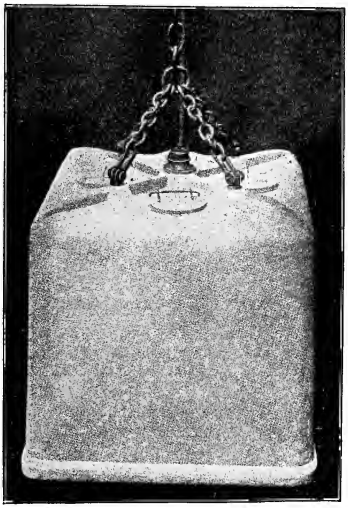
MODERN DIVING BELLS

A Submerged Workshop—Contains Several Men—Built of Strongest Steel

[For the facts and photographs used in the preparation of this article the editor is indebted to Messrs. Siebe, Gorman & Co., Submarine Engineers to the British Admiralty and War Office.]

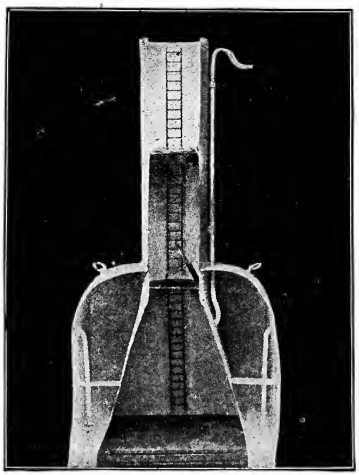
In this country we are accustomed to think of the diving bell as a relic of antiquity dating back, as it does, several hundred years from our first book in physics. Our submarine work is done by divers clad in armor and helmet, but in other countries the modern diving bell finds frequent use, and has been brought to a remarkable state of efficiency.

The early diving bells were formed of wood bound with iron hoops like a barrel. They could go down only to moderate depths and remain but a short time, "as the air contained was about 60 gal." When this was exhausted the diver became insensible and, if not drawn up and released, soon died. At 33 ft. the pressure half filled the bell with water. About 1720 the first improvement in air supply was made by Dr. Halley, secretary of the Royal Society, who with four others descended to a depth of 60 ft. and remained down one hour and forty-five minutes without discomfort. He arranged a number of casks, coated with lead to sink them, "each containing 36 gal. of air." These casks one at a time were drawn down by a rope, and the air they contained transferred to the diving bell by means of a leathern hose. The hot air in the bell was released through a small valve at the top. In 1778 the first use of an

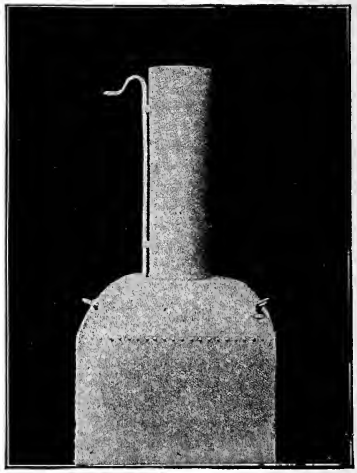


Single Diving Bell

Double Bell for Japan



Interior of Air-Lock Diving Bell—For Gibraltar



Exterior of Air-Lock Diving Bell—Illustration Greatly Reduced

air compressor on the surface to pump air down to the bell was successfully employed at Hexam Bridge, England, where two men remained under water for hours at a time. The diver's dress and helmet was invented in 1829.

The modern bell is of two types—the "diving bell," which can be let down from a dock or float, and the "air lock," which is built into a vessel specially constructed for the purpose.

The ordinary diving bell measures 8 ft. long, 6 ft. wide and 5½ ft. high inside. It is a steel box open at the bottom, with heavy glass bull's-eye windows to admit light through the top. To it are fastened four chain slings which terminate in a single chain with which the bell is lowered and raised. Every possible precaution and test is applied in the making of these chains. From the center at the top stretches the air hose and telephone and electric light wires extending to the air pumps above. Within the bell around the bottom are the blocks of cast-iron ballast, seats and footrails for the divers, and shelves and hooks for tools. A chain hoist hangs from the center of the ceiling, while the electric lights are attached in several convenient places. This outfit permits two or more men to work together, assisting each other, and with a freedom of motion which is impossible to the diver clad in armor, weighted down with diving weights, and with the resistance of water, and often tide, to contend with. The men in the bell need give no thought to their safety, nor constantly guard against the fouling or kinking of the air hose, as the diver in the helmet suit must constantly do. Even if the air pump should fail there is always sufficient air to sustain life until the bell can be raised and in extreme emergency the occupants could take chances on diving into the water through the open bottom and possibly reach the surface alive.

The largest diving bell ever constructed is pictured in the illustration, the interior measurements being: Length, 17 ft.; width, 10 ft. 6 in., and height, 6 ft. 6 in. It has straight sides permitting close approach to the work on which it is employed. It has a large complement of tools of all kinds, chain hoists, hooks, etc., and its telephone has an extra loud trans-

mitter by which the conversation of the crew can be heard at all times, and to call above does not compel stopping work. The air supply required is large and air compressors worked by steam engines are necessary. As an additional precaution the pumps deliver their air into a large steel tank which contains a reserve supply lasting 30 minutes. The hoisting of the bell is done with a steam engine.

The air lock diving bell is a large affair and is used for heavy and extended work on the bottom, such as rock drilling, building masonry piers, and undertakings requiring considerable time. It is really a steel caisson with one or more air locks opening through a large steel tube, which rises to the open air through a well built in the middle of the boat. The apparatus is raised and lowered from a tall steel platform resting on four legs, by means of steel cables on drums driven by powerful engines; counter-weights assist in the movement.

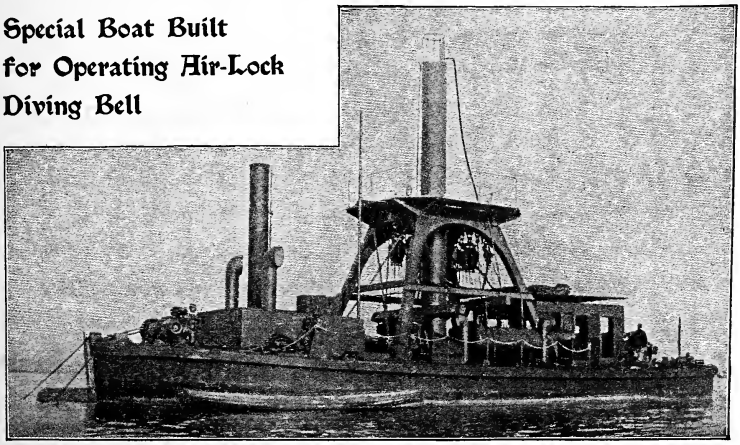
The air lock diving bell plant illustrated was built for use of the British admiralty at Gibraltar. The vessel is 85 ft. long, 40 ft. beam; the diving bell weighing 50 tons, and in addition to all the usual equipment of the ordinary diving bells contains a rock drill operated by compressed air. There is a large opening in the lower chamber out of which the water is kept by maintaining the necessary air pressure. The workmen can ascend at any time by climbing the ladder. When a man has occasion to come up he enters the air lock chamber, locks the bottom door to maintain the pressure below, remains in the lock a few minutes during which time the air pressure is gradually reduced until there is none at all, then he passes through the upper door into the tube and so on up to the top and reaches the platform. To re-enter the diving bell this procedure is reversed.

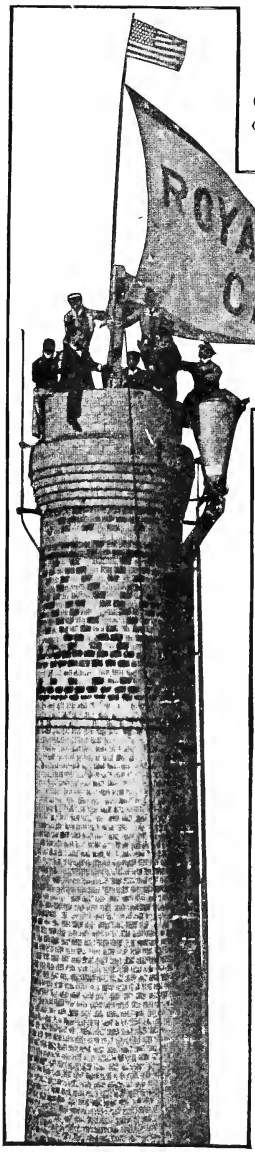
For the most part, however, submarine work is done by helmet divers in closed suits, and some of their most important and exciting experiences in the recovery of vast treasures.

The Pennsylvania railroad has planted 1,500,000 trees along its right of way during the past five years.

Iron sheets coated with aluminum are very durable and likely to supplant galvanized iron for many purposes.

Special Boat Built for Operating Air-Lock Diving Bell





Entering Banquet Hall

BANQUET ON CHIMNEY TOP

When the new brick chimney of a hotel at Atlantic City, N. J., was completed recently, the chief engineer of the hotel celebrated the event with a banquet in mid-air. A platform was built inside the chimney, at the top, and the dishes and other things were hauled up with ropes. The guests were required to "step in to dinner" by climbing the iron ladder on the outside of the stack a little matter of 150 ft. The host, weighing 206 lb., led the way to the novel dining room. The Practical Engineer says there were eight in the party and all ate heartily.

THE FUTURE TELEGRAPH SYSTEM

The bulk of the telegraphing in the world is in the Morse code, using the Morse key and sounder with few changes from the original. The reliability of the old system is what has maintained its supremacy, but there must soon come more rapid facilities, says W. J. White, in the London Electrical Review. The trouble with the typewriting systems is the difficulty of synchronizing. The machine telegraph of the future must remedy this; the ideal being one in which any typewriter operator can send a message, and the instrument at the other end will print in Roman characters what is sent.

The prediction is made that big business houses will have their private telegraph lines to the nearest office, a typewriter telegraph instrument being placed on the desk. An operator will write messages previously dictated. These will be received on a printing machine at the main office. An indicator will warn the operator there that the message is waiting. It will be taken from the receiver and despatched to its destination without delay. In a few moments the merchant for whom it is intended will receive a signal on the instrument in his office and, going to it, will get the message.

DRIVING SHIPS BY ELECTRIC MOTORS

Will the electric motor yet find a place in the propelling plant of big ocean steamers? There are those who say it will; one is a naval constructor writing in the Shipping World, London. He points out the difficulty of graduated speeds and reverses

with the present steam turbine, while recognizing their many advantages. His expectation is that the turbines will not be connected to the driving shafts, but be of the vertical type driving generators. The current will be led through cables to motors direct connected to the propeller shafts. Steam would then be used economically —which it is not now—in driving the turbines, and the ease with which various speeds, or reverse for going astern could be accomplished is evident.

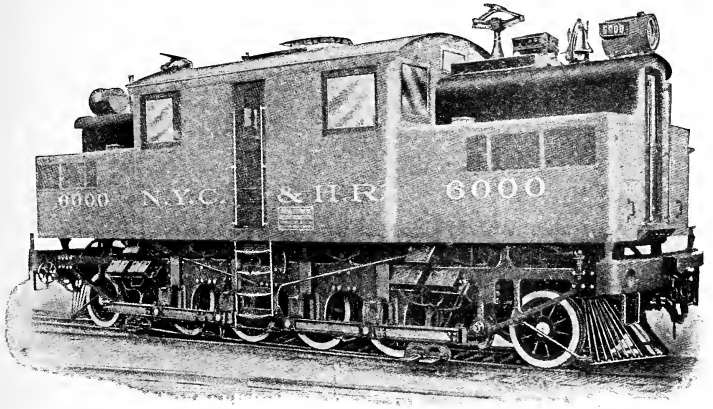
THE N. Y. CENTRAL DISASTER

One of the strangest accidents which ever befell a passenger train was the overturning of the suburban electric on the New York Central on its run out of New York City on the evening of February 16. When rounding a curve while going at a speed estimated to be from 70 to 90 miles an hour, one coach after another, beginning with the rear car, toppled over and were wrecked. The dead numbered 23 and the injured 100 or more. The heavy electric locomotive did not leave the track when brought to a stop after scattering passengers and pieces of cars along the track for several hundred feet. The accident was a mechanical crack-the-whip, and the electric locomotive was apparently responsible in that it was capable of enormous speed.

One of the railroad employes testified at the inquest he found the end of one rail sprung sideways 5 in. This, however, would seem to have been a result of the accident rather than its cause, for the rear car was the first to tip over.

It is difficult to find any excuse for the disaster, which would seem to be the result of the motorman trying to see how fast he could go; and in the matter of speed an electric car is very obedient.

There certainly was no pressing need for any such haste in a suburban train, and had the cars been of steel instead of light, flimsy wooden affairs, the dead and injured list would have been greatly reduced. Railroads resent state and national supervision, but the terrible and constantly recurring disasters of the past four months cannot be long continued without arousing public opinion to a point where very stringent legislation will not only be demanded, but enacted.



High-Speed Electric Locomotive

Commerce Commission were published, showing that the percentage of passengers killed last year is more than double that of 10 years ago, while the injured are fully three times more. In other words it was more than twice as safe to travel on steam roads 10 years ago than it is today.

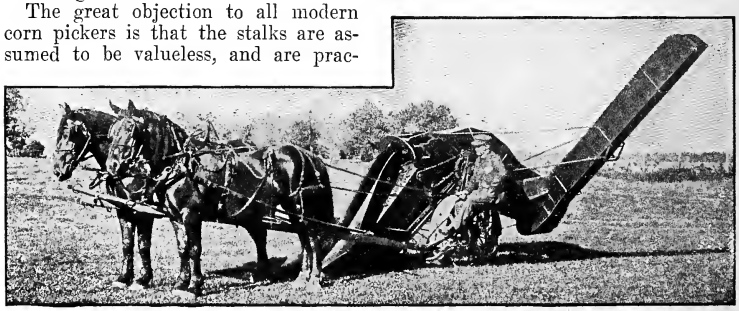
We repeat the question asked then: "Why is it?"

PICKING CORN BY MACHINERY

It is only within the last few years that anything practical in the way of machines for picking corn have been produced. Now there are several successful machines on the market, the one illustrated being a good type of all.

This picker has the guide chains with the usual prongs for straightening up the stalks. The chains form a stalk passage extending rearward through the machine. A rapidly moving chain provided with fingers is located at one side and between the guide chains in such a position that as the machine passes over the row the fingers engage the ears on the stalks and snap them off. By means of a deflector the ears are directed to a receptacle from which they are carried to the husking rollers and thence to the wagon. The tops of the cornstalks are cut off, and by means of a conveyer this and other trash is carried to the rear and dropped on the ground.

The great objection to all modern corn pickers is that the stalks are assumed to be valueless, and are practically destroyed; while every economical farmer nowadays secures his fodder with as much care as he gives his hay, knowing that it is equally nutritious.



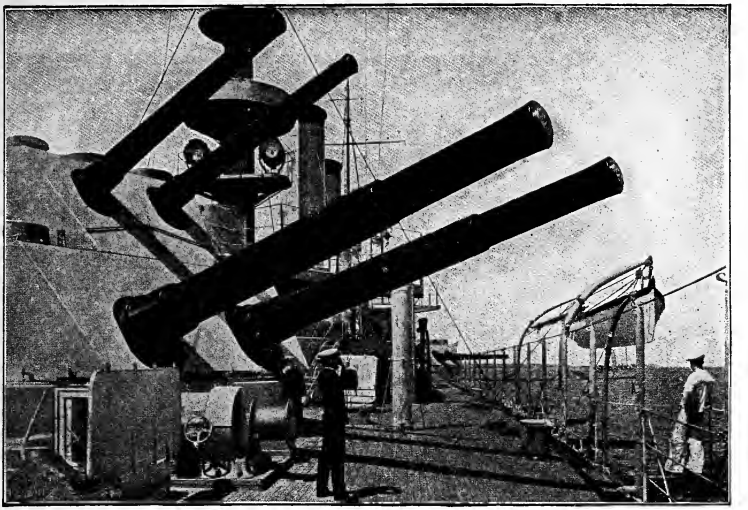
Modern Machine for Picking Corn

LEAD-GNAWING BUGS

In many tropical countries the engineers have been obliged to use iron telegraph poles because ferocious ants speedily destroyed the wooden ones. But right here in Chicago has been found an innocent looking bug with an appetite for lead pipe, and it thinks nothing of eating through the lead covering of an underground telephone

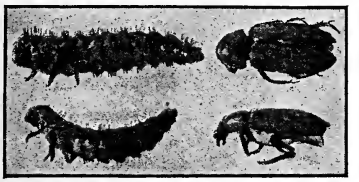
Lead Pipe Showing Ravages of Bugs

cable. It is believed it is the insulating material within the lead pipe which the beetle really craves, but this would indicate a possession of an x-ray eyesight or a wonderfully keen sense of smell. In any event the bug gnaws through the lead pipe, whether it actually eats the lead or not. The insect was discovered by experts from the Underwriters Laboratories of Chicago, in an investigation of trouble on fire alarm wires at the stockyards. Wires in the "bone-house" seem to have fared the worst, and the discovery opens up



THE BATTLESHIP "NEW JERSEY" is remarkable for her double turrets fore and aft, in each of which are mounted two 8-in. and two 12-in. guns. She carries in all 64 guns; is 435 ft. long; 76 ft. 10 in. beam; has 19,000 h. p.; speed, 19 knots; displacement, 15,320 tons; requires 703 men.

possibilities of danger heretofore undreamed of, for the question instantly arises: Can any lead covering of electric light wires be pronounced absolutely secure from leakage of current and consequent fires?



Insects That Gnaw Lead

A similar case is reported from Savannah, in this country; and from many parts of Australia where trouble of this kind has become common. The Australian bug is known to the general public as the Jesuit beetle. Another, the elephant beetle, is also addicted to lead gnawing. A covering of aluminum is now suggested as likely to resist the bug bites, but no one can tell how long this will answer, as Nature is a great provider for necessities, and the bugs may grow a new set of teeth specially adapted to an aluminum diet.

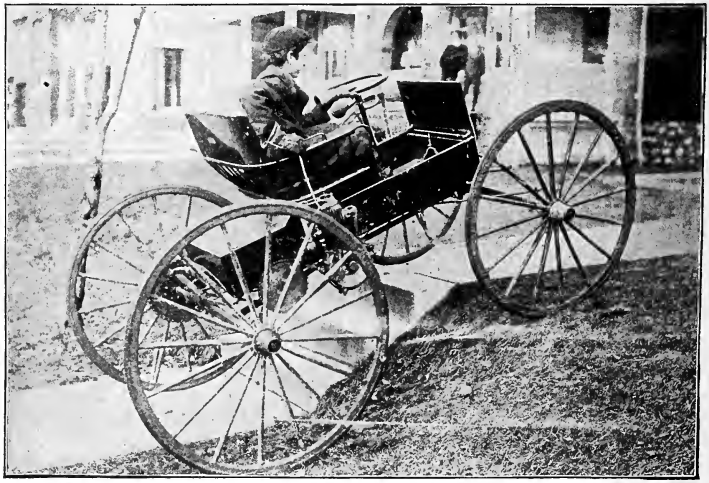
MEXICAN GOVERNMENT BUYS RAILROADS

The Mexican government, by the purchase of a majority of the stock in the most important lines of railroad in that country, has secured complete control of 7,190 miles out of a total of 10,900 miles now built. The unpurchased lines consist of numerous companies with widely separated properties and will also doubtless be absorbed some day. The government ownership consists in owning a majority of stock in a holding company, which in turn owns a majority of stock in the several operating railroad companies.

THE COMING OF THE CHEAP MOTOR RUNABOUT

The inexpensive, though practical, low-priced motor vehicle, not capable of dangerously high speeds nor embellished with all kinds of accoutrements, costing the buyer about $250, is bound to come. It will be so simple the owner will not need a professional motor engineer to run it, neither will he require a fat bank account to keep it in repair. It will correspond to the average one-horse buggy seating two passengers, and costing for horse, harness and vehicle $250. The popular two-passenger motor car will soon be available at this price—$250, and the builders will sell them by the hundreds of thousands just as the horse-drawn vehicles are now made and sold by the hundreds of thousands each year.

In fact, the advance guards of the low-priced motor buggy are already here, and several firms are making specially for rural letter carriers motor vehicles which sell from $225 up to $400. And the rural carriers with 25 to 30 miles



Runabout Built for Rural Letter Carriers

to travel over country roads each day are finding out how good they are, that the cost of repairs and supplies is about one-half the cost of horse-keep and that they can serve their routes in one-third the time, thus improving the service greatly.

The demand for cars costing thousands of dollars and in each of which the manufacturers' profit is as large as on 20 cheap vehicles, explains why the cheaper vehicle has been ignored. Their shops can contain only so many "jobs" at a time and for those manufacturers the smaller outfits would not pay.

The time will soon come, however, when the cheap vehicles will be built in all parts of the country on a scale small compared to the factories of the big makers. It will be like the making of bicycles, which at its height was most successfully done, not by factories in which all the parts were made, but in shops where all the parts were bought in large quantities from specialty makers, and the manufacturing was really only the assembling of parts and painting.

So it will be with the runabouts. Already any one clever with tools can purchase every part required to construct a very respectable and serviceable motor vehicle, which he can himself put together. Where the putting together is done in large quantities on a system of time-saving labor, a very fair vehicle can even now be sold for $250, with a good profit to the builder.

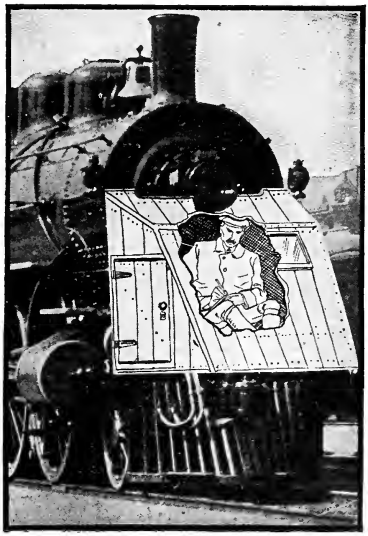
Government statisticians state that last year there were built in this country horse-drawn vehicles of all kinds a total of 1,700,000; and that of this astounding number two-thirds, or over 1,000,000 were pleasure vehicles, and of these fully 800,000 were two-passenger vehicles. Nor is the output mentioned anything phenomenal; it shows about the same gain over the previous year that has characterized the business for years past.

Is it not evident that the great numerical field for motor vehicles is not in the cars costing thousands of dollars each, any more than the bulk of the carriage business is in outfits costing $2,000 apiece? The motor vehicle will not have its day like the bicycle, although our readers would hardly believe the figures of bicycles made and sold last year. They are now being used for purposes of utility, not pleasure, and with improved pavements in cities and better country highways the time is almost here when more bicycles will be in use than ever before.

There has ceased to be the pleasure in riding a bicycle there once was, but the motor car, requiring no exertion, will always be desirable for both pleasure and utility And when the $250 motor can be had in plenty then and not until then will the horse really begin to disappear.

Five hundred thousand—half a million—motor runabouts at $250 could be sold this year of 1907 if they were ready for delivery. By another year they will be made by thousands, and no other manufacturing business today offers such opportunities for making big fortunes as this.

PERILOUS WORK OF THE SPEED TESTER



It is one thing to take the readings of a stationary engine in a nice warm power house, but quite another to make the record of a big freight locomotive. These readings are made to secure data from which are determined the conditions under which the locomotive does its best work. When a new engine comes out of the works its record of power produced with certain amounts of fuel is taken. At intervals thereafter other similar records are obtained, and to do so the operator must ride on the pilot, a perilous and uncomfortable position.

Even in summer when exposure to the weather is much less, it requires a good deal of nerve and a cool head to do the work. The speed tester frequently is obliged to lie flat, stretched at full length across the pilot, which

does not ride with the gentle motion of a Pullman. In winter a man would freeze to death in this position and a small wooden coop is built with doors at each end through which he can watch and adjust the instruments with which the "card" or record is made.

The danger of the work was brought to public attention last month in a collision on the Baltimore & Ohio railroad, in which C. T. Runnels, a speed tester was instantly killed, his body being fearfully mangled. Although he could see the approaching smash he was caged in such a manner that it was impossible to escape.

BATTLESHIP "VERMONT'S" HARD TEST

In a 50-Mile, 12° Below Zero Gale, She Exceeds Requirements

When the battleship "Vermont" steamed into Boston harbor last December she looked more like a floating ice palace than a man-of-war, having endured a trial run probably the most severe ever given any fighting ship.

The course was off the coast of Maine, and the first test, a 4-hour speed run, was made under 300 lb. steam pressure, with a record ranging from 18.25 knots up to 18.58 knots, and averaging 18.33 knots per hour. Following this was the 24-hour endurance run with an average record of 17.50 knots, but during this test a 40 to 50-mile gale was blowing with the thermometer at 12 degrees below zero. The waves that dashed over her quickly froze, until tons upon tons of ice covered the decks and turrets. Not an inch of deck or superstructure but was encased in ice.

The keel of the "Vermont" was laid on May 17, 1904, says the American Marine Engineer; her dimensions are: Length, 450 ft.; breadth, 76 ft. 10 in.; displacement, 16,000 tons; draft, 26 ft. 9 in.; horsepower, 16,500. She was launched September 1, 1905, and tested December 2, 1906. The vessel is designed as a flagship, with ample quarters for fleet officers, ship officers, and 761 men.

STEEL TIES FEARED

The steel tie has received a set-back as the result of the accident to the Pennsylvania flyer which went into the river near Johnstown. At the point where the disaster occurred the track was laid on steel ties, and while at first, officials of the company denied the ties could have caused the wreck, it is significant that a week later orders were issued for the immediate removal of every steel tie in the company's tracks.

Pig iron and diamonds are true barometers of trade. When iron is high, so are diamonds; although one is a necessity and the other a luxury.

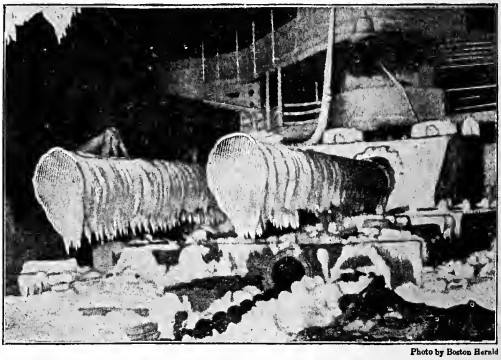
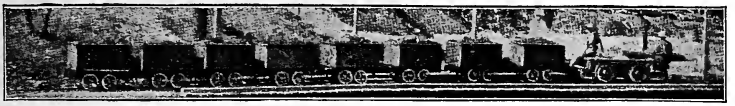


Photo by Boston Herald

The Ice-King's Leviathan

A Corliss engine can be made to do more work by raising the boiler pressure, increasing the speed, or giving less lap to the steam valves.



ELECTRIC MINE LOCOMOTIVES

Strenuous Work of Smokeless Engines Thousands of Feet Underground

Hundreds and even thousands of feet underground, in the coal, iron and copper mines of the country, electric trolley cars are running night and day, of which the public never hears. On these subterranean railroads the cars move on as exact time schedules as the surface cars, but the motorman is never laid off for failing to shine his brass buttons, and there is no sign forbidding him to talk to passengers. Through avenues of darkness the trolley of the mines finds its way, the passing of the electric headlight leaving the caverns blacker than before. In the most remote room of the farthest drift the lonely miner anxiously looks forward to the hour and minute when the electric locomotive is due, for it means release from work, and swift conveyance to the living world again. The motor is as surely driving the mule from his underground prison, as it has from the street car. The first electric mine locomotive in this country went into service in the Lykens Valley Colliery of the Pennsylvania railroad in 1887, and while many improvements have come since then, the original "Pioneer" is today still making its regular trips.

The introduction of hundreds of mine trolley cars was not founded on any sympathy for the unhappy mule, but strictly as a business proposition. The trolley is cheaper. Unless mine cars of unusual size are desired, the same light rail can be used for a trolley system, and the track and overhead wiring installed at a cost of only $200 per 1,000 ft. To this add cost of a generator of suitable size and about $2,500 for each locomotive.

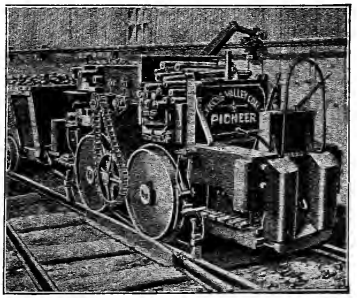
As an illustration the following figures taken from a small mine using only one locomotive will show the saving. The entire cost of locomotive and all other machinery and wiring was $7,625; and the cost of hauling 288 tons of coal per day, is $7.96 or 2.76 cents per ton, for the following:

Station engineer	$1.75
Motorman	1.75
Helper	1.60
Repairs	.76
Depreciation	1.90
Oil and waste	.20
Total	$7.96

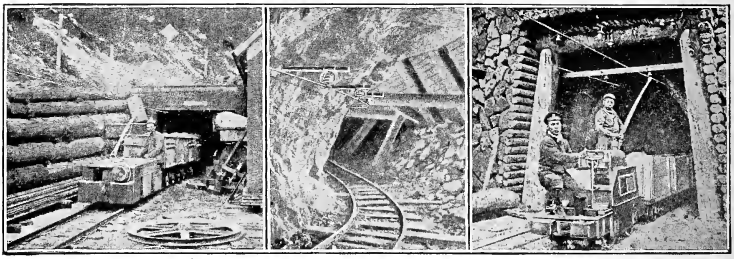
To haul this coal by mules would require:

Seventeen mules at 50c each	$ 8.50
Three drivers at $1.45 each	4.35
Three drivers at $1.25 each	3.75
Four boys at $1 each	4.00
Total	$20.60

or 7.15 cents per ton; a saving by electric haulage of 4.39 cents per ton. The saving per year at this mine is $2,528 or $12.64 for each of the 200 working days. A mine system of electric haulage pays for itself in from one to four years out of the saving in cost of opera-



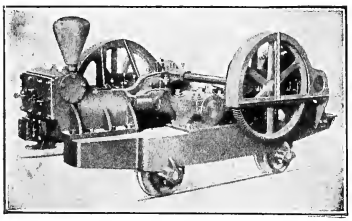
The First One



Kellogg, Idaho Hancock, Mich. Ashio, Japan

tion; in fact one mine has a big electric locomotive which cost $4,500 and saves the company $6,000 each year. Some of these lines are very far underground, one copper mine in Northern Michigan is operating an electric railway 4,400 ft. below the surface. The overhead trolley system is considered best for underground work and is the method generally employed, the wire being suspended on small brackets along one side of the tunnel. The trolley pole is short and made of wood, while the trolley wheel is of the usual type. The locomotives run in either direction by manipulating a small lever, and some of them weigh as much as 13 tons. The steeper the grades in a mine the heavier and more powerful must be the locomotive.

These mine engines possess an advantage not enjoyed by any street car, for they can go several hundred feet beyond the end of the trolley wire. This permits runs to newly opened parts of the mine without the necessity of extending the overhead wires each day, and is accomplished by means of a cable reel carried on the car which automatically makes connection with the end of the feeder wire and unwinds as the car proceeds, supplying current to the motor. On the return trip the cable is picked up and rewound on the reel. All this is accomplished without any attention whatever from the motorman.



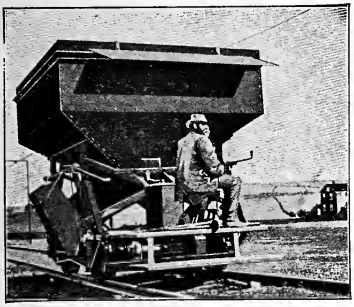
Electric Mine Pump

Another interesting machine is the electric pump car. This consists of a very powerful pump driven by a motor taking power from the trolley wire. The outfit is mounted on wheels and can be hurried to any part of the mine and is ready to go to work the moment its destination is reached. It is used both in extinguishing fires and in keeping down the water until a permanent pump can be installed. It throws a stream of the same size and force as an ordinary steam fire engine.

Locomotives used in pick-up work, hauling cars from the chambers out on to main lines where trains are made up weigh from 4 to 6 tons. One motor will serve 20 or more chambers taking out the loaded cars and switching in the empties, amounting to about 250 cars per shift. The locomotives are so compact they can work where mules cannot stand upright.

Above ground the mine locomotive finds plenty to do in hauling materials about the yard, switching, and other work which would require many horses or mules. Coke ovens are now generally served by electric motor cars with immense steel hoppers, called larries. The electric larry weighs 3 tons

and carries 6 tons of coal. It runs on an all-steel track along the top of the burning ovens where it is extremely difficult to work animals on account of the heat, flames and gas. The electric larry shies at none of these and accommodatingly dumps its load into the red hot opening on whichever side of the track the operator wills.



6-Ton Electric Larry

It was a great day for mules and managers when the first electric mine locomotive went into business.

WHY "MADE IN GERMANY" BEATS "MADE IN U. S."

We Americans are convinced we can do most things better, and certainly much quicker than anybody else. And in very many cases this is literally true; in other instances it is true only in so far as the doing is for home consumption. We look out on the increasing markets of the world and it seems impossible that foreigners could prefer any make of anything to that stamped with a triumphant Eagle. But this thinking does not cinch the export trade, and what American manufacturers don't know about the very first elements of exporting would fill large books.

We have demonstrated what is best for us, and therefore we should be the judge of what is best for those buyers abroad to whom we would sell. In so doing we forget that people are much alike the world over after all, and that one of the things a Yankee most resents is having anybody else assume to tell him what he wants!

In commenting on the import into Brazil of pianos and musical instruments, Kuhlow's German Trade Review (Berlin), speaks of the wealth and musical culture of Brazilians and adds these significant words:

It is one of the very best fields for activity in all the Latin countries, yet U. S. A. exports of musical instruments to it are so small as to be hardly worthy of the name.

The three great exporting nations of the world in manufactured articles of all kinds are Germany, England and the United States. Yet Germany, possessing neither the wealth nor the population of either England or the United States, surpasses its two rivals in the profitable, complete and thorough way in which they obtain the control in every country where they seek to make the German goods known.

It is not altogether a question of price; and making the piano as cheap as the German will and landing it at Rio de Janeiro, or any of the other ports in Brazil, will not capture the trade. The Brazilian has wishes, prejudices and tastes which must be catered to. The German does it. Neither the English nor the Americans try. Hence the German gets the trade, and everybody talks about the American invasion of this, that and the other country, but does little or nothing.

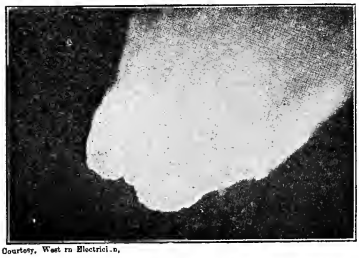
A bit of history will illustrate the point. John Stephenson was the first and for some years the only builder of street cars. One day a manager came to his factory in New York, and ordered some cars for a new line in Albany. Price and all details but one were agreed upon. The buyer said the cars would run out to a suburb where the people were Scotch, and to please them he wanted the outside panels of the cars painted in a plaid. Stephenson refused to paint the cars in that way, and rather than do so let the buyer go to another concern for his cars, which he did.

If the Brazilians want their pianos polished with stove blacking, and a medicine chest over the keyboard, and will not have them any other way, and are willing to pay a price profitable to the manufacturer, it is a short sighted policy which fails to fill their wants, as the wanters want them, and with goods bearing the words "made in U. S."

ELECTRIC STEAM FIREWORKS

A Novelty in Outdoor Color Display

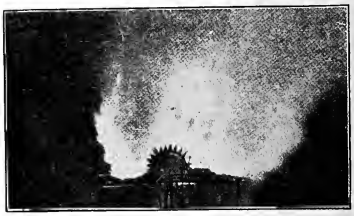
The latest thing in fireworks involves no fire at all—that is no fire that can be seen, for the most beautiful effects of color are obtained with electric lights and some clouds of steam. The current for the electric searchlights is secured from any convenient supply, and the colored screens are the same as used nightly in every theater, but the artificial clouds necessary as a background for the colored lights is interesting.



Courtesy, West ro Electricl.o,

The Fan Effect

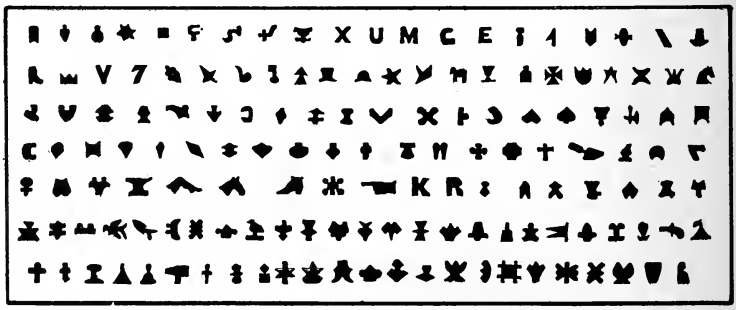
A good sized portable boiler, on wheels, furnishes the steam which must be at about 75 lb. pressure. The steam is conducted through iron pipes into frames of various shapes, made of pipes with numerous small openings. The escaping steam rises in a sheet producing a moving cloud effect, and when the colored lights are played from ten or more searchlights the result is a novel delight. Not only colored lights but portraits, landscapes, marine views and moving pictures can be thrown on the clouds of steam in combination with changing color schemes. One slide which calls out special applause is the American flag in its red, white and blue, and when this is thrown on the steam, the waving effect is perfect and it is hard to believe one is not actually looking on a silk flag 50 ft. in length.



Electric Sunburst

The flags of all nations will be displayed in this manner every night at the Jamestown Exposition.

Trout Lake, Minnesota, is to be drained at a cost of $2,000,000 because the water leaks into the Canisteo iron mines.



An infinite variety of dies are used in railroad conductors' punches. Did you ever see one of these in your ticket? One manufacturer alone has over 500 punch dies, no two alike.

PHOTOGRAPHING A VOLCANO

One of the most daring feats in photography ever undertaken is to be attempted by a Mr. James, an American, in the Hawaiian Islands. If he does not perish in the effort he will secure moving pictures of the lava when it overflows the pit of Halemauman, in the immense crater of Kilauea.

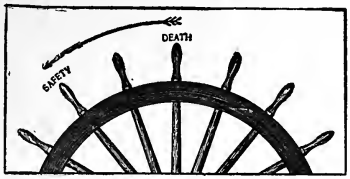
The lava is now boiling and bubbling in the pit, shooting upward in cones of 75 to 150 ft. in height. The lava in the vast cauldron has risen hundreds of feet, and it is believed will shortly overflow the sides of the pit which was 800 ft. deep about two weeks ago.

Mr. James proposes to have the picture machine near the crater when this lava slops over and show in actual motion the progress of the running, spouting molten mass. Such views would not only be thrilling and realistic, but possess great educational value.

The time is near at hand when a motion picture machine will be considered as necessary a part of the equipment of every high school, as a dictionary or maps.

The same instrument would be used in a great variety of ways, teaching in an instant and with the utmost exactness what would require pages of text. In geography, botany, geology, natural history, physics, chemistry—in fact in every branch the stereopticon will be of incalculable value. Such machines, and good ones, can now be bought for less than $100 and last practically forever. The matter of light has also been solved with a cheap, simple and effective lighting outfit.

The largest and heaviest double gate valve in the world was recently installed in a power plant at Niagara Falls. It contains over 60 tons of metal and the parts are over 9 ft. in diameter. It is large enough for a man to ride through on horseback.



THE "LARCHMONT" DISASTER

"A turn of two spokes of the wheel to port on both vessels five minutes or less before they struck, as they were evidently intending to pass each other to the right, would have allowed them to pass each other uninjured, and the 150 innocent persons sacrificed would have been alive today, as the schooner struck the steamer on her port side, the side the schooner should have passed without colliding."—Editor Marine Journal.

It's the old, old story of the tragic sequence of what appear insignificant things. A careless flagman goes back only a little way and when the unexpected train appears, signals too late, and a terrible collision occurs.

A telegraph operator omits one word in the message he is sending and the next day men loathe the name they had always honored.

A carpenter is building a dock at a summer resort, and his supply of nails of suitable size giving out, he finishes the job with the smaller ones at hand. A month later a merry throng crowd the platform and some are drowned as the structure goes down.

An electrician slights a job of wiring —it's concealed, no one will know it— but one day the cry of "fire" is heard in a vast audience and scores are crushed in the panic or burned in the flames.

A clerk is filling a simple, harmless prescription, and absent-mindedly takes down the wrong bottle. His remorse is sincere but it cannot restore life to the dead.

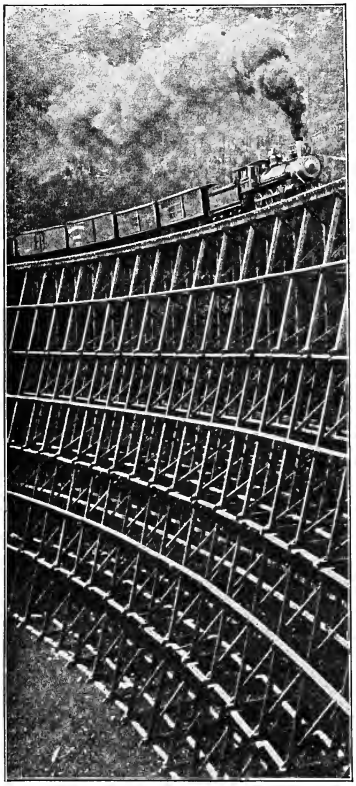
An operator touches the wrong lever; the power of mighty engines instantly responds; and a great cauldron pours out tons of liquid metal upon the helpless men below.

This is not a sermon. It is the

lesson of awful consequences which may follow the failure to rightly do the things which, by reason of their often doing, seem commonplace and insignificant.

GREAT TRESTLE BRIDGE ON VANCOUVER ISLAND

A massive wooden trestle which carries the track of the Esquimalt and

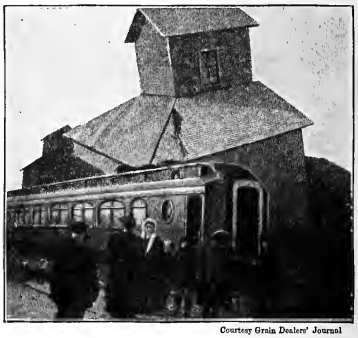


195 Ft. High

Nanaimo railway over the Niagara Canyon in Vancouver Island, B. C., is 585 ft. long, and the rails are 195 ft. above the water. The trestle, which contains about three-quarters of a million feet of timber says Railway and Locomotive Engineering, was built when timber was cheaper and steel bridges not so much in use. The wooden bridge and the wooden trestle are purely American products, although invented by Leonardo da Vinci in the sixteenth century.

TRAIN WRECKS GRAIN ELEVATOR

One of the strangest accidents that ever befell a grain elevator happened at German Valley, Ill., when a 50-mile passenger train on the Great Western plunged through the building. In the wreck the elevator was demolished, four passengers were killed and many others nearly smothered under the thousands of bushels of grain that poured down. The engine missed the build-



Courtesy Grain Dealers' Journal

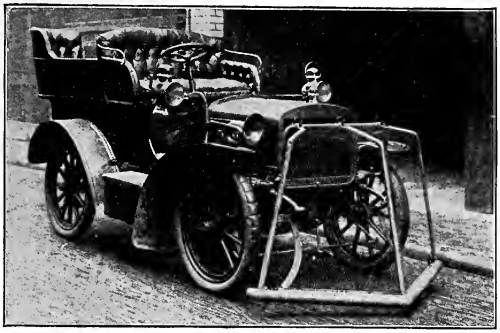
A Peculiar Accident

ing but the mail car went through the elevator and the other cars piled up around it.

In England the telephone apprentiee serves three years. In the shop, 6 months; with experienced instrument setter, 3 months; in switchroom, 18 months; testroom, 3 months; and on instrument faults, 6 months.

An alloy of two metals often melts at a lower temperature than either of the metals it contains.

ENGLISH AUTOMOBILE LIFE GUARD



English Auto Car Guard

The life guard shown in the illustration attracted a good deal of attention in London last month as a possible remedy of the many fatalities which attend the reckless operation of motor cars. There has been some newspaper talk in England indicating there may be a law passed requiring a life guard on every motor car. The guard or "cowcatcher" shown looks much less unsightly than one would expect of such a contrivance, judging by the monstrosities which most street cars in American cities carry in front.

That the protection of pedestrians from being run over may become compulsory even in the United States is by no means unlikely, for during the past winter bills were introduced in more than one legislature, though we believe none became a law. Owners of motor cars would dislike for many reasons to be obliged to carry a guard although it would not look queer as soon as generally used.

RECESSION OF NIAGARA FALLS

Greater on Canadian Side

In a pamphlet by G. K. Gilbert of the U. S. Geological Survey, much interesting information is given on the recession of Niagara Falls. On account of the greater volume of water passing over the Horseshoe Fall, and the consequent removal of fragments of rock at its base, the wear is very much greater than on the American side where the water is comparatively shallow.

A record of 63 years, ending 1905, shows an average recession of the Horseshoe Fall of 5 ft., while the American Fall has only averaged 3 in. per year for 78 years.

BY RAIL TO TOP OF MATTERHORN

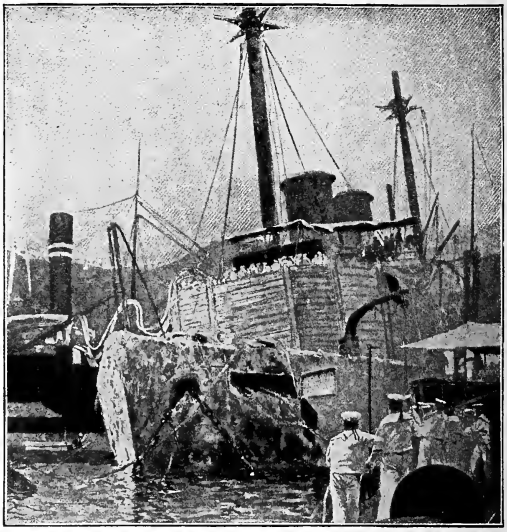
Only 40 years have passed since the first ascent, on foot, was made to the top of the Matterhorn. Within four years a cog railway will land passengers at the very summit, 14,780 ft. above the sea. There will be one almost perpendicular tunnel 7,700 ft. long, or rather high, for the grade will be 85 per cent. At the top a hotel will be excavated in the rock, with rooms looking out upon the magnificent panorama. One room will be supplied with oxygen for treatment of tourists who suffer from the altitude. The ascent will take 90 minutes; fare for round trip $10. The trip is now made on foot in 24 hours, up and back; cost of guides $40.

Pat acknowledged himself puzzled. "They call it an indecent electric light," said he, "but it do beat me how they make the hairpin burn in the bottle."

JAPS RAISE THE "MIKASA"

Togo's flagship, the "Mikasa," has been raised after lying for nearly a year at the bottom of the harbor of Sasebo. It will be remembered the battleship exploded in a mysterious manner and sunk in a few moments while at anchor. The cause of the disaster is now known to have been spontaneous combustion due to the decomposition of chemicals. The Japs never consider a vessel lost simply because she has gone down. All the Russian ships which were sunk at Port Arthur have been raised and are now afloat and in service of the Japanese navy. Japan has recently launched her thirty-third destroyer built since the war, has recovered two of her own battleships and is building seven more heavy fighting ships.

A land to land voyage of three and one-half days is planned for a steamer line from Halifax to Black Sod, Ireland.



The "Mikasa" as It Appeared When First Brought Into Dock After One Year on the Bottom

PROPER CARE OF AUTOMOBILE SPRINGS

The springs of an automobile should be well looked after and when the car is not in use, jacks should be placed under the frame, in order to take the weight of the car off the springs and tires, says Automobile Topics. This serves a double purpose, inasmuch that the springs are allowed to retain their proper shape, and the tires will last longer if the strain is removed when not in use. When the weight of the car is taken off the springs, it will be found an easy matter to insert the point of a screw-driver, or any similar tool, between the spring-plates, forcing them apart sufficiently to inject grease or any lubricant, between the leaves. This will remove all possibility of the springs squeaking when riding over uneven surfaces, and will always improve the riding comfort of the car.

SNAKE-BITE LANCET

An inexpensive instrument called the "snake-bite lancet," the invention of Sir Lander Brunton, has been introduced in India with splendid results. It is being distributed by the government in an effort to reduce the fearful loss of life which amounts to 75,000 persons each year.

A report by one person is to the effect that he had saved the lives of 20 persons bitten by cobras and karaits within the last year by the use of one lancet.

SUICIDE STOPS WATER SUPPLY

One man in his successful effort to kill himself threw 400 men out of employment for three days and caused the closing down of a large industry. The plant, which is built on the shore of Lake Michigan, in Chicago, requires immense quantities of water, which is pumped from the lake through an 18-in. main. The man was seen to jump into the water near the intake, but could not be rescued. A few minutes later the water supply failed and the works were shut down.

Owing to the great blocks of ice which a storm was driving upon the shore it was impossible for divers to go down for three days, when the body was found tightly jammed in an elbow of the big pipe.

CONCRETE PRESSURE PIPES

Pipes made of reinforced concrete for transmitting water under pressure have been constructed. These pipes are really one continuous tube, each several hundred feet long. In diameter they are from 2 ft. to 3 ft., the longest single section being 600 ft. The inside is made quite smooth, planed lumber being used in the forms.

CART BEFORE THE HORSE

The very latest Paris novelty in the vehicle line is a four-wheeled surrey in which the cart is actually before the horse. Another feature which attracts attention is the driver, who is a woman.

A 1907 Model

This 1-hp. motor starts and stops on command, and has two speeds forward; the machine is not constructed to reverse. No lines are used, the conveyance being directed by means of a steering wheel. The outfit has not yet been arrested for fast driving.

EGG-BLOWING ON ICE

A new game which has been quite a fad in Europe the past winter is egg-blowing on ice. The Illustrated London News says:

Good for the Lungs

Every woman player has a man for partner. Parallel tracks are marked out for each pair and all start level, the ladies, on skates, forming a line at one end of the course, the men, wearing shoes or boots, at the other. Partners face partners. First the ladies skate forward, blowing the eggs along with fans. As soon as they reach the other end, the men fall flat and wriggle along, blowing the egg back again. The partners whose egg gets back first are the winners. The sport is immense and even the gravest dignitaries have been known to bend to its charms.

TO BUILD AUTO TOLL ROAD

To promote a toll road would seem like going back to early days, but a $10,000,000 company has already begun construction on a 45-mile auto toll highway in New Jersey. There are to be two 35-ft. tracks, divided by a 30-ft. roadway elevated 4 ft., to be occupied by a double track railroad for motor drawn trains.

PHOTOGRAPHS TELEGRAPHED 1,000 MILES

Great Improvements Make Transmission a Practical Success

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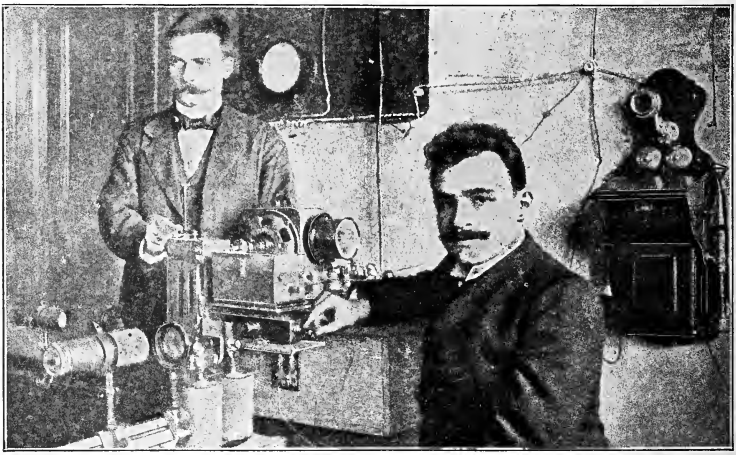
Professor Korn, of the Munich University, has so perfected his previous apparatus for telegraphing photographs that he pronounces the transmission a practical success. His former accomplishments were remarkable, but the pictures were far from satisfactory. He has now wired portraits from Munich to Nuremberg, a distance of 100 miles, and also made transmission over 1,125 miles of wire in his own laboratory, in 18 minutes. He expects with some changes to soon have apparatus which will overcome the high resistance of submarine cables and enable him to send a photograph 6 by 7 in. from London to New York in 12 minutes.



Photograph of Prof. Korn in his Laboratory, with Apparatus for Telegraphing Pictures

Reference to the diagram will make the following general description plain to our readers: The photograph which has to be transmitted is placed on a transparent glass cylinder which revolves slowly and at the same time moves from right to left. A ray of light is thrown on the cylinder by means of an electric lamp and lens, and when the ray of light reaches the interior of the cylinder it is brighter or darker according to the coloring of that particular part of the photograph over which it passes.

Inside the cylinder is some selenium, which transmits electrical current in proportion to the intensity of the light brought to bear on it. The selenium transmits current more rapidly in bright light and less rapidly as the light decreases. The selenium is connected with the wire over which the photograph has to be transmitted.

The receiving apparatus consists of

Photograph of Crown Prince of Germany, Transmitted 1,000 Miles: Large Picture is Reproduction of Small Original in Lower Corner

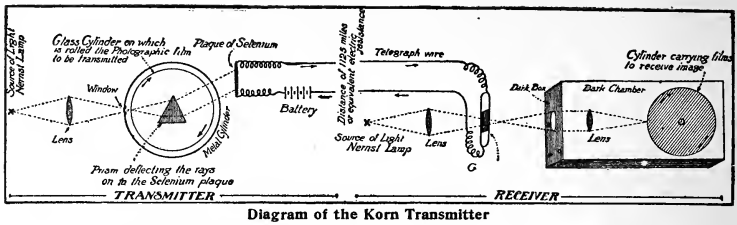


Diagram of the Korn Transmitter

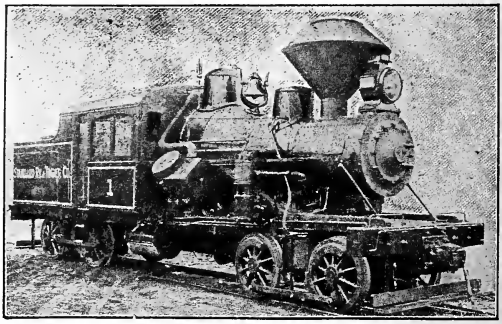
an electrical Nernst lamp placed inside a glass cylinder covered with sensitized paper. The lamp burns more or less brightly according to the varying current transmitted through the selenium at the other end of the wire. It thus reproduces the exact shade of the original photograph, provided that the cylinders at each end of the wire revolve at exactly the same speed. The revolution of the cylinders is regulated so that speed is identical at both ends.

Professor Korn was born in 1870 at Breslau and studied at Leipsic, Berlin and Paris. For 11 years past he has been professor in Munich. His first public announcement of the transmitting apparatus was made three years ago, at which time the pictures were blurred and uncertain. He has worked constantly ever since and his pictures now are clear and accurate.

A GEARED LOCOMOTIVE

Where ordinary locomotives are not suitable for hauling timber, ore cars, or for other similar service on steep grades, uneven track and sharp curves, the geared locomotive is often used.

Unlike most locomotives, the engine is located near the center and operates a longitudinal shaft, provided with universal joints similar to those in an automobile. The power is transmitted to the first and last pair of wheels by 2 to 1 bevel gears driven by the longitudinal shaft, the second and third pair of wheels receiving power by means of connecting rods as shown in the illustration. The engine is of the opposed type and revolves twice to every revolution of the drivers. This gives it great tractive force, and as the entire weight of the locomotive rests on the drivers, slipping is reduced to a minimum. It is said that the tractive force of the locomotive shown in the illustration and which weighs 52 tons is double that of an ordinary locomotive of the same weight.



Powerful but Ugly

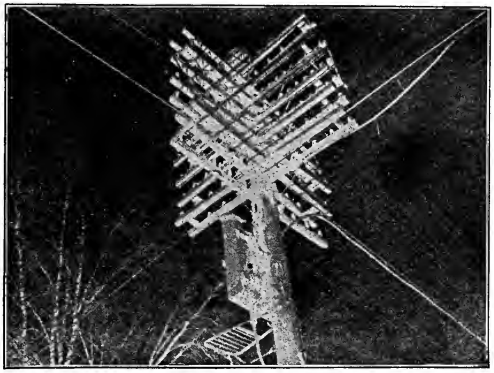
A new food prepared from kelp, a long, slimy, tubular sea plant, has been placed on the market. The preparation is made into confections, jams, preserves, marmalades, sweet and sour pickles and citron. The food is called seatron.

PHOTOGRAPHING WITHOUT PLATES

A short time ago I was entirely out of photographic plates and wishing to get some pictures of some snow scenes I thought of putting regular artificial light printing paper in the place of the regular plate. Well, it certainly worked fine. I enclose a negative; also a proof made from it. This is not, of course, a beautiful picture by any means. My reason for taking this is because I did some wiring at this box this summer and hence especially interested.

By experimenting with the paper I found that if the back of the paper were covered with a small amount of lard or oil and this allowed to soak in just before printing that it would render the paper almost transparent and a print could be made by this process in about one-third of the time the other would take. After the oil, or whatever is used, has soaked in pretty thoroughly a soft cloth or blotter must be used to wipe off all surplus oil. Great care must be taken so as not to allow any of the oil to come on the face of the negative, because when this is placed for printing the oil or lard will get on the printing paper and will keep it from toning, the same as in handling the paper with the hands if they are moist.

The best exposure is a minute and ten seconds with a wide open top. The paper may be of any standard grade of lamplight printing paper. You will probably notice the brownish tint on the one I am sending; this is due to the developer being old. I have some better ones, but they are pasted in a book. The advantage over plates is this: They can be loaded in the plate holder in daylight; that is, not too bright, but should be loaded under a yellow or subdued light. Then they may also be developed in the same light. In printing the picture the film side of the paper should be placed against the printing paper the same as with plates. Of course, pictures of this kind are not practical except for time exposures out of doors. But this is a more convenient way of having the negatives, and, what is better, they are a whole lot cheaper.—Stewart H. Leland, Lexington, Ill.



Picture Made Without a Plate

WRECK OF WRECKING TRAIN

A wrecking train on a Michigan railroad, while running at 50 miles an hour to reach a wreck, was itself wrecked by going through a bridge, and down 40 ft. into a river 20 ft. deep. The car containing the crew of 11 men, who were asleep, landed on top of other cars, and the occupants all escaped drowning by climbing out through the end of the car. Strange to say, none of them was seriously injured. Six cars, including the 75-ton hoisting crane went down, but the locomotive, which was pushing the train, did not, being derailed and hanging partly over the break.

FOOTBALL ON ROLLER SKATES

A new English sport is football on roller skates. The Illustrated London News says: Football on roller skates was inaugurated recently for men at Brighton skating rink, and the pastime was very soon taken up by women. The game is played six a side; there are three forwards, two backs, and a goalkeeper. The goals are 6 ft. high and 7 wide, and the regulation football is used, with a little over a pint of water in it to keep the ball from rising. Twelve feet in front of each goal is drawn the penalty line. Down each side run the boundaries. When the ball gets into touch it is not thrown in, but is placed on the boundary line, and pushed into play with the side of the foot. Hustling is allowed, but not charging. Outside his own penalty area the goalkeeper must not handle the ball. Two minutes is allowed to repair skates.

The game is fast and furious and creates great excitement.

FREIGHTER "COLE" LARGEST LAKE SHIP

The largest fresh water vessel in the world this month is the "Thomas F. Cole," launched at Detroit. It secures the title by being five inches longer than 605 ft. which is the length of each of two other lake freighters which will go into service at the same time this season. When seen at a distance none but experts can distinguish the extra five inches that make the vessel rank first in size.

"Hustling is Allowed, But Not Charging"

FIRST AMERICAN WINTER BALLOON FLIGHT

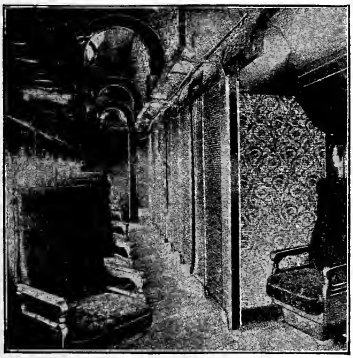
The first winter balloon flight undertaken in this country was made at Pittsfield, Mass., January 25, by Leo Stevens and Capt. Lovelace. The ascent was made at 3:10 p. m. with temperature reading 14° above zero. At 3,500 ft. the instruments recorded 25° below zero, and fearing death from freezing a descent was made, landing two miles from the starting point.

PUMPING WATER FROM COAL MINES

The cost of anthracite is always more or less affected by the 500,000,000 gal. of water that is pumped out of the Pennsylvania mines every day. The 1,000 powerful engines deliver from mine bottom to surface 500,000 gal. of water a minute. In 1905 the average pumped out per day was 633,000,000 gal.

TROLLEY SLEEPING CARS

Trolley sleeping cars are now in regular service on interurban lines in Illinois connecting two large cities 150 miles apart. The cars differ from the conventional sleeper in having revolving chairs instead of cross seats, which make the lower berth, and in wooden roller curtains which come up out of the floor to form partitions, with 18 in. between the berth and the partition in which to dress. Each partition has a cloth curtain-door. There is nothing unusual about the upper berths; passengers clamor for them just about the same as on steam lines. The cars are 56 ft. long and weigh 50 tons each, accommodating only 20 passengers. The service is already in considerable demand.



Trolley Sleeping Car

EXHIBITION BY FRENCH FIREMEN

At the international gathering of firemen at Milan the rope climbing ac-

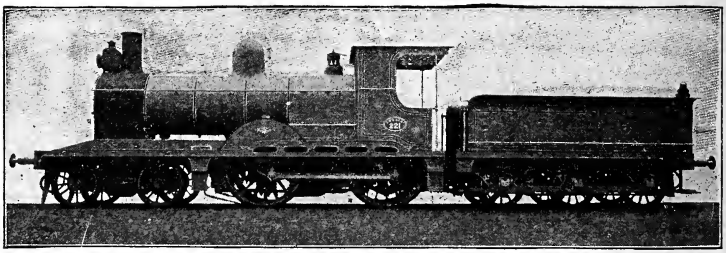
Rope Climbing Test

complishments of the French attracted much attention. A lofty wooden structure was erected to represent a tall building, and up the side of this the Paris firemen climbed on ropes with great rapidity and daring.

WINS WATER WALKING BET

Captain Oldrive won in his novel undertaking of walking on the water from Cincinnati to New Orleans, a distance of 1,600 miles, in 45 days. The prize was $5,000, and he had 45 minutes to spare. His wife accompanied him all the way in a rowboat. He used shoes made of cedar 4 ft. 5 in. long, 5 in. wide and 7 in. deep, fitted with hinged webs like a duck's foot.

The effective range of torpedoes is increasing, and is now from 3,500 to 4,000 yd.

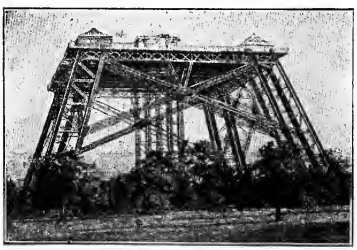


NOTABLE FOREIGN LOCOMOTIVES.—Express passenger locomotive of the Bombay, Baroda & Central India Railway. These engines are driven by Europeans, each driver having two natives as firemen. The gauge of the railway is 5 ft. 6 in.

A SECOND TOWER OF BABEL

When the Eiffel tower was completed in 1889 there arose in England a popular demand to go the French one better, and it was decided to build a tower which should make Mr. Eiffel's tower look like a pigmy in comparison. Money was raised, a company formed, and the work begun on a grand scale. The English tower was to be 1,200 ft. high, and at various levels was to contain museums, theatres, restaurants and many other places of amusement.

The location selected was Wumbley and four years was allowed for its completion. When the vast structure reached the first landing, 150 ft. above the ground, all of a sudden public interest ceased, and no more money could be secured to continue the work. For 16 years the massive framework has stood as a monument of excited folly, and now it is being wrecked for what salvage there may be in the steel.



An English Folly

MILLIONS OF HORSEPOWER IN UNITED STATES

To make the wheels go around in all the mills and factories in the United States more than 15,000,000 hp. are required every day, which is growing some when compared with a total of 2,346,000 in 1870. The increase for the five years ending 1905 was 39 per cent. In that year the division was:

Owned—	Horsepower.
Steam	10,664,560
Gas	289,514
Water	1,647,969
Electric	1,138,208
All other	91,784
Rented, miscellanies	632,905
Total in use, 1905	14,464,940

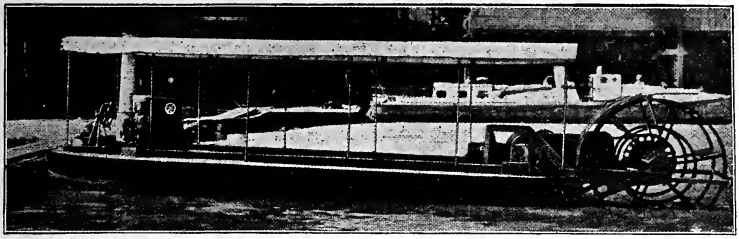
Even these figures, large as they are, must be considerably under the actual, for many power users are at remote points, where the census man seldom visits.

It is interesting to note the increase during the 10 years from 1890 to 1900 in the following powers:

Steam power increased	77.7 per cent
Gas engines increased	1,408.9 per cent
Water power increased	15.9 per cent
Electric increased	1,895.4 per cent

Steam power shows an increase of 77.7 per cent for the 10 years ending 1900, but it is a smaller gain by 31.9 per cent than for the previous 10 years. When the census of 1910 is taken the gas engine will doubtless show another big advance and steam a corresponding loss.

The gold, silver, lead, copper and zinc mines of Colorado produced $50,000,000 during 1906.



This stern-wheeler was built in England, taken apart, shipped to Terra del Fuego, and reassembled there. It is used in dredging gold.

ELECTRIC FANS FOR FURNACES

A novel application of electric fans has been made the past winter with satisfactory success in connection with hot air furnaces in residences. One section of the cold air duct leading from outdoors is made of 17-in. pipe, and in this is placed a 16-in. electric fan. The fan is of the ordinary summer type and runs from the same supply which lights the house, the expense being about one-half cent per hour while running. Its use is only necessary, however, when heating the house early in the morning, or during very windy or extremely cold days. When the fan is in motion it forces a great supply of air into the heating chamber of the furnace, and from there through the various pipes to all the registers in the house. The cost of installation is trifling, it will last for many years, and insures plenty of fresh, hot air in any room at any time. A furnace expert says that with the fan system much smaller warm air pipes can be used and still secure abundant heat.

AIR BRAKES FOR AUTOS

Air brakes may replace the present method in general use on automobiles, the compression being secured direct from the motor cylinders without the use of any compression machinery. It is estimated that approximately one-tenth of the engine power of a car would be required to work the compressor. By the direct method this loss would be entirely eliminated.

The dimensions of brake cylinders for cars of the heavier type have been estimated as follows:

6,000 pounds.....	5	in. diam. x	12 in. long
5,000 pounds.....	4½	in. diam. x	12 in. long
4,000 pounds.....	4	in. diam. x	12 in. long
3,000 pounds.....	3½	in. diam. x	12 in. long
2,000 pounds.....	3	in. diam. x	12 in. long

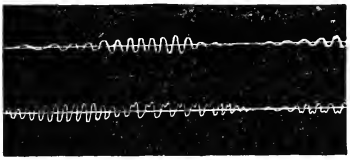
TREE STOOD WITHOUT ROOTS

In Tasmania, Australia, a large gum tree was to be cut down and the workmen sawed across the trunk two feet above the ground. When the cut was finished the tree slipped off the base, but instead of falling remained upright as shown in the illustration. It remained in this remarkable position for several days until a windstorm toppled it over. The stump will be seen at the right of the picture which is reproduced from a photograph taken by the editor of the Australian Traveler.

The Rootless Tree

PHOTOGRAPHING THE VOICE

The voice camera, by means of which speech is recorded photographically in wave-like lines, was made possible by the high-speed telegraph system described in Popular Mechanics for April, 1905. By this system writing is recorded telegraphically at the rate



Record Produced by Human Voice

of 40,000 words per hour, against the Morse instruments' 400.

In photographing the voice a microphone is substituted for the transmitter and the vibrations cause a mirror in the receiver to oscillate, while the tones are reproduced on paper in such a way as to indicate the quality of the speaker's voice: black and strong for a strong voice; small and fine for a weak voice. The instrument will be useful in testing voices and also in showing their development under cultivation.

Another adaptation of the system is its use in conjunction with a vibrator which makes vowel sounds audible to the deaf. The possibilities of the apparatus in this field are unlimited and its practical efficiency has already been demonstrated in the case of several deaf and dumb persons.

MAKING CLIMATE TO ORDER

The Colorado river was again returned to its original channel on February 11. If it stays there the Salton Sea, covering 2,800 square miles, will in a few years dry up and the inundated land be again recovered. The evaporation from the sea during the past six months has caused a startling change in climate, rain and snow falling over vast areas which for centuries have been dusty deserts. Even Death Valley has had copious rains, which if continued would soon make it inhabitable. People whose land is above high water mark want the sea perpetuated.

The interesting demonstration of a changed climate bears out the predictions of French engineers who want to cut canals and let the waters of the ocean in upon the Sahara Desert, with view to changing the climate of all northern Africa and making tillable millions of acres which are now worthless desert.

DOORYARD GOLD MINING IN SIBERIA

At the Orsk gold-fields in Siberia the peasants mine the gold in their own yards. Our illustration, from the Illustrated London News, shows them eagerly at work, though the temperature registers 20° R. below zero (—13° F.).

These prospectors are called "tributors." They may sink shafts wherever they like, provided they go down no further than water-level (usually

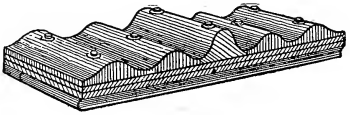
Primeval Mine Hoist

Peasants Mining Gold In Front of Their Huts

about 60 ft.), treat all quartz extracted at the mill of the ground landlord, and sell all gold extracted to him at a rate previously fixed. The rate leaves a fair profit for the peasant and a good one for the landlord. No charge is made for the use of the mill and the "tributors" frequently make fortunes.

CORRUGATED SKIN FOR PLEASURE BOATS

A patent has been granted on a novel feature in boat construction. The Motor Boat says: In boats built on the new system the skin may be in two or more thicknesses, the inner being corrugated and fitted transversely from gunwale to gunwale over the keel. This corrugated inner skin corresponds to the usual inner framing and renders it unnecessary. This inner planking is covered with a fabric saturated with a water-proof solution and on it is worked one or more diagonal skins of light veneer, according to the strength required. The outer skin is worked longitudinally in narrow strips similar to the well-known packed form of construction, the joints being filled with a water-proof solution and forced together under heavy pressure. When this is smoothed down the outer skin is practically seamless. The whole structure is fastened together with copper rivets and burrs. Where it is desired to have an especially smooth exterior finish, the outer surface is roughened and covered with an elastic



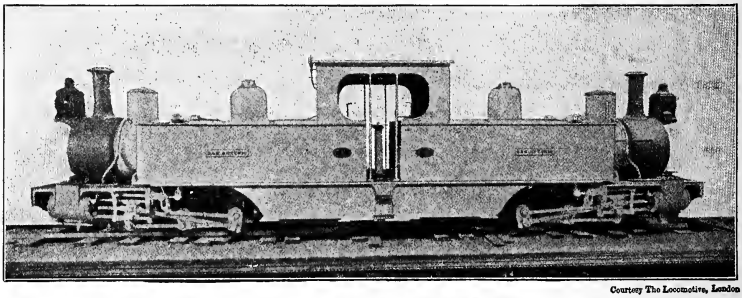
Corrugated Skin

cement. Upon this another layer of fabric is stretched and rolled into place with hot irons. Two or three coats of paint on this surface produce an absolutely smooth finish without the possibility of leak or deterioration from the weather.

Automobiles are getting to be quite handy. The latest accessory is an electric cigar lighter which is guaranteed to work in a hurricane.

QUEER LOCOMOTIVES IN BOLIVIA

The Siamese-twin effect illustrated in the picture is the result of a definite purpose, and not as might well be imagined, a freak locomotive made to pull itself apart. This type of engine, built in England for the Bolivian Railways, is so constructed on account of the terrific grades which frequently are as steep as 1 ft. in 35. Under such conditions if a single boiler of necessary length was used all the water would frequently be at one end or the other of the boiler, with disastrous results. Hence the Fairlie type, as it is known, was designed, using two boilers, each fired independently of the other. The machine is really two small complete locomotives backed together and connected permanently. The water tanks are on each side below the cab floor; the coal storage is in the side tanks above.



Courtesy The Locomotive, London

Built This Way on Account of Grades

The center line of the boilers is only 4 ft. 10½ in. above the rails; the track gauge is 2 ft. 6 in.; the drivers are 2 ft. 6 in.; cylinders, 12½ in. by 16-in. stroke; diameter of boilers, 3 ft. 5½ in.; length of boiler tubes, 9 ft. 3¾ in.; rigid wheel base, 6 ft.; total wheel base, 29 ft. 4½ in.; boiler pressure, 160 lb.; weight, 52 tons.

CHINA SHEETS INSTEAD OF WALL PAPER

The perfection of a method of manufacturing porcelain in large sheets one inch thick is announced in England. The sheets can be decorated to order in any desired design and then glazed by firing. When placed on the walls of rooms the effect is said to be beautiful, and of course the material is highly sanitary. This would obviate for all time redecorating, wall papering and spring house cleaning, and deprive the lady of the house of the two grandest events of the year.

The china is made of a mixture of ground Cornish clay and French flint boulders, and can be sold for $2.50 per square yard.

EIFFEL WIRELESS STATION

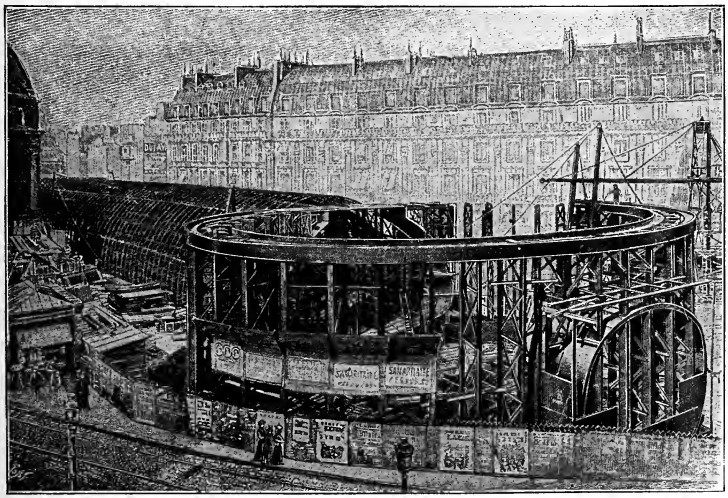
The French army has been experimenting with the Eiffel Tower as a wireless station with such excellent results the government has decided to make it a permanent station. It thus becomes the highest station in the world, although other stations are in operation at greater altitudes. Messages have been exchanged with Berlin and other cities.

TUNNELS BUILT ABOVE GROUND

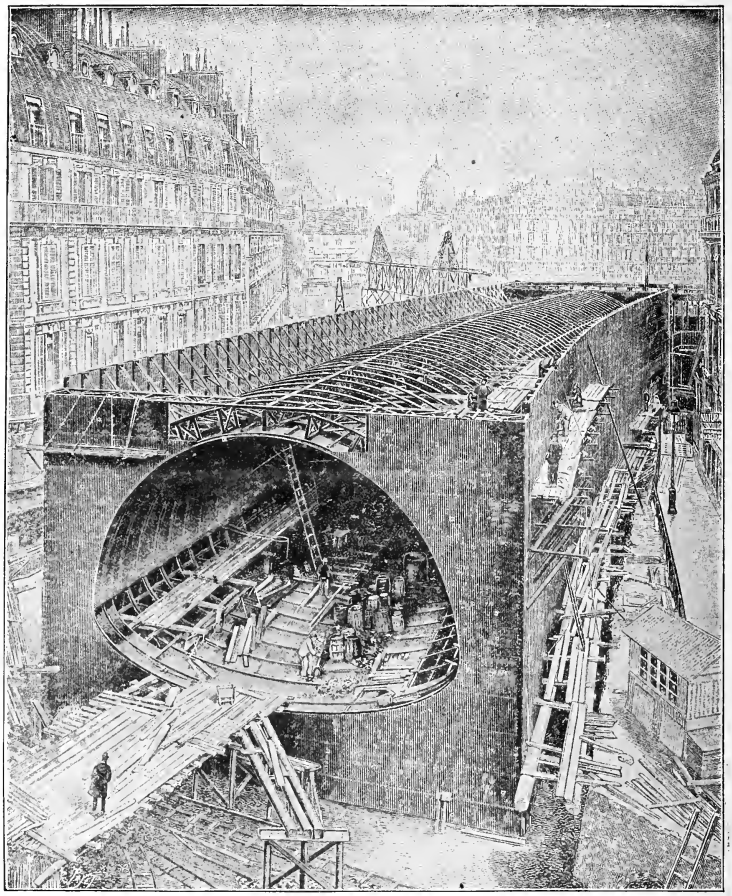
To be Undermined and Sunk 80 Ft. When Completed—A Very Unusual Undertaking

Two underground depots and a considerable length of connecting tunnel, for the use of the Metropolitan subway lines of Paris, are being constructed on a public street, and when completed will be sunk into position. In other words, this unusual piece of engineering work consists in building a tunnel in the open air.

The main line of the Metropolitan railway crosses the two branches of the Seine and the Isle of Cité, which divides the river, at a point just south of the Bridge St. Michel. That portion of the line which crosses the island is being built in the street, where the great steel framework rising to the top of the third story of abutting buildings attracts much attention. The sections which are to cross the river have already been described in these pages, having been built on land



Framework of Depot and Section of Tunnel; Weight 18,000 Tons



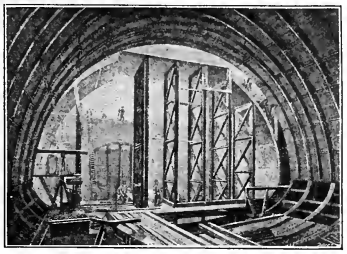
Tunnel Being Built in the Street

and floated to location, where they are being sunk to the required level below the bottom of the river. The land and water sections mentioned are 5,800 ft. in length.

The illustrations convey a good idea of the construction. When completed the inside measurement of the tunnel will be 78 ft. wide by 56 ft. high. There are two land sections 1,500 ft. and 1,800 ft. long respectively. Inside the steel framework will be placed a thick lining of concrete to exclude water, while the sides and arch will be covered with white enameled tiling and the floor with cut stone blocks and slabs, upon which the track will be laid. When the metal section is finished, excavation will be made beneath it and the great mass allowed to gradually

settle to permanent position at the proper depth.

Two depots are included in the work described, both located on the island. These are obtained by enlarging the tunnel to a ring-shaped construction, with provision for ticket offices, waiting rooms, etc. One of the depots with 500 ft. of tunnel weighs 18,000 tons. The reader will readily appreciate the nicety of operation by which all these metal sections are to be sunk to an exact level and then bolted together where the end of one length joins that of the next. The project is one of the largest and most interesting engineering undertakings in the world at the present time. When the tunnel and depots have been sunk, the street will be replaced and paved as before. All the riveting is being done with pneumatic hammers of American make.



Showing Interior Work

PLAN TO DIG INTO A LIVE VOLCANO

And Build a Breakwater with the Foaming Molten Lava—Most Unheard-of Engineering Project Ever Conceived

Volcanoes have ever been considered sources of tremendous destructive force, uncontrollable in their action and of no useful purpose to man. The unusual and daring proposition is now made to make at least one active volcano perform constructive work of positive commercial value. The idea seems to have been adapted from the familiar one of drawing molten iron from a furnace and conducting it along the earthen floor through shallow open trenches into molded spaces where it cools and becomes the pig iron of trade.

Hilo is the important seaport on the east coast of the Island of Hawaii, in the Sandwich Islands group. Its harbor facilities are insufficient to meet the demands of present day commerce, and in order to provide suitable shelter, great breakwaters must be constructed at large cost. Congress has been petitioned to make the necessary appropriation, but so far has not advanced beyond an order for a preliminary survey. The people of Hilo evidently realize that Congress is a long way off and, unless action is secured soon, propose to tap an active volcano on the island and make it furnish the material and do the work of construction at the same time. If the plan works a great sea wall will have been built, of greater extent and weight than any ever before constructed by human skill.

The idea is to construct a big trench from Mt. Kilaueau to the shore and then tunnel into the pit of one of the craters and release the molten lava, just as a furnaceman opens a cupola when making pig iron. One difference will be that where the founder uses a long iron rod to poke a hole, the volcano is to be opened by letting off a big charge of high explosives.

Notwithstanding the somewhat fishy nature of the story, it is stated "engineers who have been considering the scheme are strongly inclined to the opinion that it is not impracticable." One thing is certain, there will be plenty of Yankee engineers who will not hesitate to undertake so difficult and dangerous a venture, if the necessary funds are provided.

PECULIAR WRECK OF STEAMER

One of the most unique marine pictures ever made is that of the Steamer "Carrington" which went on the rocks recently. The ship was stranded in such a way that at low tide the stern being in deep water went down with the ebb, see-sawing the bow high in the air. Although the vessel was in this perilous position several days the hull did not break and the ship was finally pulled off, floated and saved.

MOVING PICTURES SECURE NAVAL RECRUITS

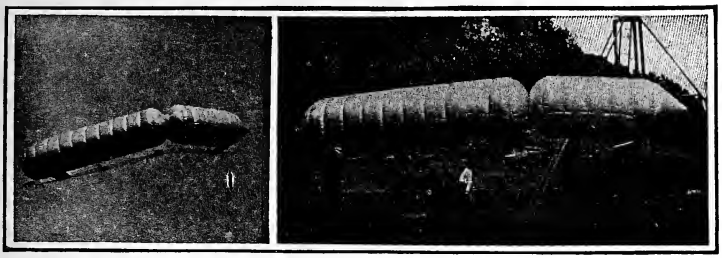
The navy department is using moving pictures depicting the sailor's life, as a means of securing recruits for the service. The pictures show all phases of the life, from coaling the vessel and scrubbing decks to sham battles and drills. The apparatus is making a tour of the northwestern states, where there are many Swedes and Norwegians, who make the best sailors.

MOTOR CAR FOR WIRELESS WORK

An interesting application of the motor car has been made by the Marquis Solari, secretary to Marconi. It consists of a wireless station complete with generator, receiving and sending apparatus, and a telescopic pole which can be quickly extended to considerable height. The station will work reliably over distances up to 90 miles. Some of them will be used in the Italian army.

In Traveling Gear **Tower Raised**

AIRSHIP THAT STEERS LIKE A BOBSLED



In Mid-Air

Ready for Flight

From San Francisco, famous for aeronauts and airships, comes a new idea in construction. The inventor is August Kidder, who has been working on the problem for the past seven years. The illustrations show his latest model, 27 ft. long, with which he has secured results he considers very satisfactory; in fact, so promising, he is now at work on a large ship which will be 250 ft. long.

He uses two gas bags, the forward one being the smaller, and with this he steers, the larger following in the same way a train of cars follows an engine around a curve. The motor and operator are carried on frames suspended from the bags, of which there may be several if desired. The bow of the forward bag is cone-shaped.

BIG BATTLESHIPS ARE THE BEST

Lieutenant-Commander William S. Sims, inspector of target practice in the navy, in an article written for the United States Naval Institute in reply to an argument by Captain Mahan for small ships, declares for big ships of the all big gun type, not only because they are the more efficient, ton for ton, than smaller battleships, but because they are more economical in both original cost and cost of maintenance.

"A fleet of ten 20,000-ton ships," says Lieutenant-Commander Sims, "each having a broadside fire of eight 12-in. guns, or 80 in all, would cost about $100,000,000. A fleet of 20 smaller vessels, each having a broadside fire of four 12-in. guns, or 80 in all, and the usual intermediate guns, would cost about $120,000,000 or $130,000,000, though I previously assumed the cost of these fleets to be equal, in order to accentuate the tactical value of large ships.

"It requires fewer men to man the main battery guns of an all big gun ship than of a mixed battery ship. For example, it requires fewer men to serve the ten 12-in. guns of the 'Dreadnought' than the four 12-in. and sixteen 6-in. guns of the 'Missouri.'

"It will require no more men for the 'Dreadnought's' crew than it would for the 'Missouri's,' if she had a complement of men, as measured by European standards, which neither she nor any of our battleships has."

PRIVACY ON PARTY TELEPHONE LINES

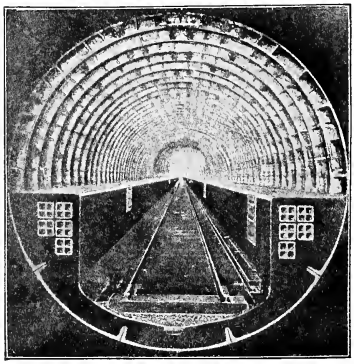
A New York inventor claims to have perfected a device that will put an end to eavesdropping on party telephone lines. The device can be connected to any 'phone and only those carrying on the conversation can hear what is said.

VERY LATEST LARGEST OFFICE BUILDING

The largest office building in the world this month is the proposed down-

Contains 4,000 Offices

town terminal of the Hudson River Tunnel Co. This structure will rise 22 stories above the street and extend down through 25 ft. of basements. Features of the building include: Large arcade for stores; 4,000 offices



Section of Tunnel

accommodating 10,000 people; 39 elevators; 5,000 windows, and 30,000 incandescent lights; while in the basement depots tunnel and subway trains can be taken for Jersey City, Brooklyn, and all parts of New York City.

DYNAMITE

By D. S. Brewster, Explosive Expert

Dynamite was discovered in 1866 by Alfred Nobell. The principle consisted in using an absorbent commonly called a "dope," which would take up the nitroglycerine and hold it somewhat after the manner of a sponge. A suitable "dope" should be of cellular structure, so that the nitroglycerine may be subdivided into minute globules, each globule held separately in its own cell, completely isolated from the others. In this condition its sensitiveness is greatly reduced, depending, of course, upon the amount of nitroglycerine absorbed.

Nitroglycerine is made by treating a quantity of exceedingly pure glycerine with a mixture of nitric and sulphuric acid. The proportion commonly adopted is 3 parts of nitric acid, 5 parts of sulphuric acid, and from 1 to 1.15 parts of glycerine. The glycerine is added very slowly and with constant stirring. Wood pulp, nitroglycerine, sodium nitrate and sulphur are thoroughly incorporated and put in cartridges, usually 1¼ by 8 in. in size, these cartridges being packed in paraffine paper.

An explosion is a chemical reaction which is completed in an exceedingly short period of time with the evolution of a large quantity of gas at a very high temperature. If this reaction occurs in a body which is closely confined, the expansive effort of the highly heated gases produces disrupted effects. If the suddenness of the reaction is very great, disrupted action upon solid objects in contact with the body may be obtained even when it is not confined, because the cohesion of these objects can be overcome more

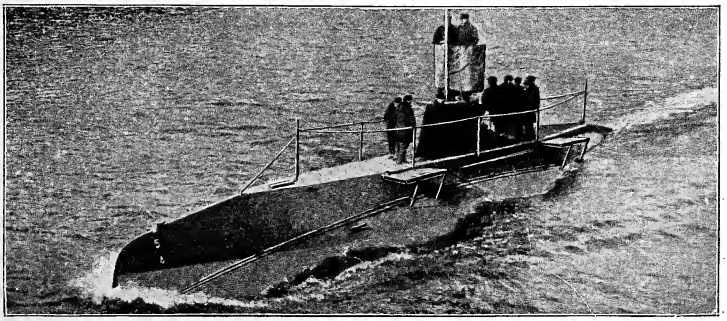
readily in an instant of time than the inertia of the surrounding air. This has given rise to a popular error that nitroglycerine and other high explosives act downward. As a matter of fact they act with equal force in all directions.

In small quantities, dynamite will burn quietly, but with large quantities the heat thus generated will bring the entire mass to the explosion temperature before it has burned away. It freezes at temperatures from 42° to 45° F., which often necessitates thawing it before it can be used. Dynamite should not be thawed by direct heat from a fire or a stove. There is also more or less peril of producing leakiness and starting decomposition by thawing it in the sun. There is peculiar peril from thawing it in the sun when the rays are turned through a window, as the imperfections in the glass are apt to focus the heat at a common point.

There are only two safe ways to thaw dynamite, viz: In a room heated by steam pipes, in which case the explosive must never be laid on the pipes, and in a vessel surrounded by warm water. The proper temperature of the water is 125° F., which is the approximate temperature at which the bare hand can just be held without pain. The water should be heated separately and poured into the water space in the thawer, and the thawer should not be heated near a stove or other source of heat.

Many accidents occur from the use of dynamite, the usual cause being carelessness. Among these causes are the following: Quarrymen carrying cartridges and detonators in the same hand; forcing cartridge into hole with iron bar; striking portions of unexploded cartridge while clearing away débris after the blast; deepening a hole which had been fired and had not done its work; investigating misfires when fuse failed; testing a hole with an iron bar after the blast to see if any of the charge remained.

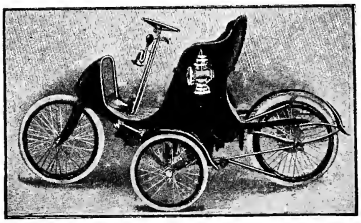
Besides ordinary blasting operations there are many other purposes for which dynamite has been successfully used. It is often used for blasting ice to make way for ships or other objects and is used quite extensively for removing stumps or trees. Dynamite is also useful for breaking up cannon, condemned machinery and large castings to be remelted, and in the hands of an expert can be used for these purposes without any danger. It is occasionally exploded under water for recovering dead bodies which have sunk to the bottom, and has been unlawfully used in the same manner for killing fish.



NEW SUBMARINE "OCTOPUS" the Largest in the U. S. Navy, on Trial Test—What Appear to be Platforms Are Hydroplanes to Prevent "Plunging."

THE AUTOCYCLE

A new motor vehicle with four wheels but driven on the plan of a motorcycle has made its appearance.



Speed, 40 Miles

This machine weighs 380 lb., has a 6-hp. motor, is said to develop a speed of 40 miles an hour, and capable of turning in a radius of 7 ft. The seat will accommodate two passengers. Most of the weight is carried on the forward and rear wheels, which are 28-in. diameter. The side wheels, 24 in., are balance wheels. The front and side wheels are connected by steering gear and all turn in unison. It is claimed this machine will safely turn in a radius of 30 ft. at a speed of 20 miles an hour.

ENGINEERING EVENTS IN ALASKA

By Chas. W. Tennant, Dawson, Y. T.

Mining with steam dredges last summer was so successful that 10 additional machines will be added this season. The ground is found to be less frozen than formerly supposed and in many places the frost does not exceed 10 ft. in depth, which is thawed by steam points taking steam from the dredge. Water powers are to be utilized in summer; one large turbine plant is already installed which will have a transmission line 35 miles long. Fuel is very high, which makes steam power expensive.

A leading greenhouse man of Dawson has installed an acetylene plant to furnish light for growing vegetables and flowers during the dark season.

Capt. J. J. Healy has arrived with his men and will soon begin the survey for the Trans-Alaskan-Siberian railway. Local engineers consider the project of tunneling Behring straits a feasible one. The railroad now running into Dawson has been operating all winter and will be extended 75 or 100 miles this summer.

A large skating rink occupies one of our largest buildings: no trouble to freeze natural ice day or night.

BUCKING SNOW IN SCOTLAND

During the past winter there have been unusually heavy snows in Scotland. The illustration shows a train which was stuck for 24 hours in a 10-ft. drift. The two engines sent to its relief were also stalled, and three more locomotives with plows were sent to release the other two, which were stalled in 15 ft. of snow. The line was finally opened by a shovel gang of 150 men, who dug through 600 ft. of drifts.

Unusual in Scotland

CONQUEST OF RIVER AND SEA

Thrilling Account of the Building of the Great Dam to Check the Colorado River

By Edgar L. Larkin, Director Mt. Lowe Observatory, Echo Mt., Cal.

[This intensely interesting account of one of the most daring engineering feats ever undertaken is reprinted here from the copyrighted article in the Open Court for January by permission of its publishers. About the time the article appeared the river again broke its barriers. President Roosevelt has asked Congress for $2,000,000 to check the flood which threatens to submerge 12,000 homes, 1,500,000 acres and destroy $700,000,000 of property.—Editor's Note.]

"Water has stopped pouring into the Imperial Valley," said the telephone in a little hut of poles, thatched with willows on the brink of the subdued river. And the 12,000 people below heard all about it in an incredibly short time. Almost two years of brooding anxiety had been their fate, but suspense and care turned to joy in the space of one-fifth of a second when the news came. One of the most remarkable engineering problems of this or any other age had been solved. Here is the problem: A stream of water saturated with silt, whose width was 3,000 ft., had to be cut off. The depth of the water was from 9 to 12 ft., with a velocity of flow of 12 ft. per second. But the bottom, banks and adjacent lands for square miles round about are composed of pure silt. This substance is ground as fine as flour, and dissolves almost instantly when water touches it. The silt is of great but unknown depth, certainly not less than 2,000 ft., possibly 5,000. It came from Colorado and Utah and was ground in that great mill—the Grand Canyon of the Colorado, during hundreds of millions of years. Piles driven in it to hold up a railroad could not be depended upon for a day. The stream was growing wider and deeper minute by minute, and costly fields of grain, grass and fruit were being hurried away to the Salton Sea. Annual floods in the Colorado were sure to come and make the break miles in width, forever beyond hope of filling.

Epes Randolph, H. T. Cory, E. Corillo and Thomas J. Hinds stood on the bank of silt and wondered how the devastating floods could be conquered.

"Central, please." "Hello." "Give me the Southern Pacific, Los Angeles," said Mr. Randolph, speaking into the receiver of the telephone in the now historic hut.

History may never record the words spoken to and fro, but here is what happened right away: Two grand divisions of the Southern Pacific Railroad instantly went out of the goods-carrying business. Every car filled with any kind of freight was unloaded at once, and no more were received for shipment. Telegraphs and telephones everywhere began to speak. Now let us see what other events at once took place.

Thousands of men seized bars and picks, and with steam-drills and great cranes attacked granite mountains in every stone quarry within 350 miles. Dynamite and giant powder thundered at the rocks by night and by day. Every quarry was rushed with cars. Goods-cars, coal-cars, flat-cars, lumber-cars, steel-cars, cars, no end of cars, filled every siding. The entire southwest was stripped of cars. Passenger traffic often gave way to monster trains of stone-cars. When the battle with the flood was at its height, stone-laden cars were attached to express trains. Only mail trains had full right of way. Before this a spur railway from the main line had been laid to the brink of the flood. Before the thousands of cars from the quarries arrived new sidetracks were put down everywhere on the silt beds on which to store cars for the approaching conflict.

Excitement grew, and so did the width of the river. And then 2,200 cords

of tall, slender willows were cut and piled high on the bank where the end of the enormous dam was to begin. A large flat-boat or barge was anchored by the shore close to the willow heap. A straight row of piles was driven across the stream and ⅝-in. braided wire steel cables were attached to them. These held the barge from going down stream. Twelve "dead-men," great logs, were buried in the silt banks. Twelve colossal spools of cable were placed on the far side of the flat-boat. Skids, or inclined planes, smooth on top, were placed between the spools and edge of the boat near the shore. The ends of the cables were anchored to the "dead-men." Many cords of willows were placed on the boat.

Then hundreds of men made fascines—bundles of willows 20 in. in diameter and 90 ft. long, bound with wire. Twelve cables nearly 8 ft. apart were twisted around the bundles in double loops. The fascines were the woof and the cables the warp of a leafy carpet 90 ft. wide and 3,000 long. When a strip had been woven of suitable length, a steamer pulled the barge into the river. The spools revolved, the cables unwound, the beautiful Brussels carpet slid down the skids, dropped into the water and sank to the bottom, anchored by cables to the row of piles up-stream. A pile driver followed and put down the carpet-tacks—piles from 40 to 60 ft. in length—through the willows and tacked this Axminster to the soft floor of silt. And then silt began immediately to settle in between the twigs and leaves. Then two rows of piles were set across the river; heavy timbers were laid on the tops, then the ties and rails of a railroad of great strength were placed on this massive foundation, quite necessary, as will be seen later.

Before any of these preparations had been made, a bypass 50 ft. wide had been cut around the place where the north end of the dam was to start. A massive head-gate was placed in this pass at a cost of $55,000. The purpose of this cut was to carry part of the water from the front to the rear of the dam while building, and relieve pressure as the dam rose higher and higher. The gate was to have been kept open until the big dam was completed, and then closed. This and the dam would cause the water to rise and pour into its original bed and go smiling on its way to the Gulf of California.

When the sidetracks were filled with thousands of cars of rock, activity began. First, a long train moved from the north side of the river across to the south. This was occupied by hundreds of men armed with steel bars and pikes. The huge stones were pried off the cars, when they fell with crash, rattle and roar into the river and settled on the carpet. A train on the north end of the railroad was emptied at the same time; and then more trains, and still more. On they came without cessation, day or night. Thus the dam advancing from both ends kept narrowing the space between the approaching bulwarks of massive stones. When this space contracted the speed of the water began to increase. With more contraction, the river above the dam commenced to rise slowly, and then a little faster.

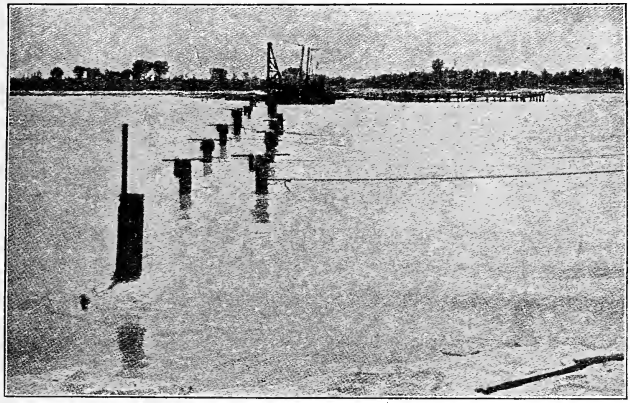
The water got its shoulder under the Rockwood gate and away it went with rush and roar. Consternation and dismay filled every mind—except those of the four engineers. Gloom spread throughout the Imperial Valley. It is not known what thoughts raced through the minds of the four; but the 1,050 workmen could not detect one trace of fear. Instantly every man left the great dam and attacked this unlooked-for danger-problem. For unless the bypass were closed immediately the silt banks would vanish and the two cuts would join into a break a mile or more wide and forever seal the doom of Valley Imperial.

Sleep disappeared, piles were driven, and a railroad was thrown across the bypass in haste. And then rocks rained. Trainload after trainload went out of sight in the boiling flood. And trainloads of gravel, clay and sand. Finally, the heap appeared above the water; and then more trains emptied on the crest

to bring it up to level with the banks. The floods in the deep cut were thus conquered, and then they backed around in front.

The diverted Colorado River that had been displaying its rage at the dam in low, sullen, but ominous tones, now began to roar. As the ends of the dam drew nearer, the roaring grew louder. The water surged, boiled and seethed in anger. Its speed increased with every trainload of rock hurled into its face. Water weighs 62 lb. to the cubic foot, and when in rapid motion its momentum becomes one of the most formidable powers in nature. When the gap grew narrower, not only did the velocity of the flood greatly accelerate, but the river began to rise, and pressure on the dam became enormous.

At sunset November 3, the time for fear, wavering and faltering came. No hope of help from the bypass; all the waters that went through that now had to be dealt with in the center of the great dam. The destruction of the gate changed every plan. Suppose one to be engaged in building a house by plans



Piling for Railroad Bridge—Velocity of Water 12 Ft. Per Second. Photo by Lubken

Items of the Dam:—Length, 3,000 ft.; width at bottom, 250 to 300 ft.; height when finished, 44 ft.; cords of willows used, 2,200; piles 40 to 60 ft. in length, 1,100; feet of railway trestle built, 3,800; miles of ⅝-in. steel cable, 40; tons of rock in dam, 70,000; cubic yards of earth by cars, 200,000; cubic yards of earth by horses and mules, 300,000; locomotives employed, 8; men employed: Caucasians, 600, Indians, 450; cost of dam, $1,250,000; time in building actual dam, 86 days; acres of rich land involved, 1,500,000; miles of canal jeopardized, 300.

made by an architect, and that when half finished something should suddenly occur to prohibit the use of the specifications, but circumstances were such that the house must be built in haste or a vast sum of money would be lost. The chances are that the scheme would fail and the loss ensue. The Assyrians and Babylonians in their engineering along the Tigris and Euphrates, and the Egyptians with the Nile, had ample time. But there was not a minute to waste on the Colorado.

Here is the case: 1,500,000 acres of land in the Imperial Valley, pronounced by United States government experts to be as rich as that in the delta of the Nile, were in danger of reverting back to a desert waste, forever deprived of water. The homes of 12,000 people, square miles of rich grains, grasses and fruits, six little cities, hundreds of miles of railway track, and thousands of domestic animals, these and more, were on the verge of destruction. For already the bottom of the diverted river was lower than its primeval bed by 10 feet, and still cutting lower. The fact stared them in their faces that the costly system

of canals would soon be destroyed; and that the awful desert conditions would assume dominion; and that every human being and animal must leave the beautiful vale, never to return.

Rays from the falling sun just before they were cut off by the vast granite rim of the Salton Sink fell on four faces and brought out lines of determination set and fixed as though cut in flint and adamant. These were the engineers "cumbered with a load of care." For the eyes of every hydraulic engineer were watching from afar every move to see which would come out victor, man or river. And the sun's fainting light fell on the faces of 600 men of the Caucasian race and 450 Indians—all selected men, trained like soldiers for this dangerous war: Americans, Spaniards, Mexicans, Frenchmen and Germans, together with Cocopahs, Mariposas, Pimas, Diguones, Yumas and Mojaves, who formed the largest number of American Indians ever at work in one body.

When darkness fell the electric lights flashed upon the weird and entirely unique scene. The river was rising and the impetuous flood roared louder than before. The terrific speed of the pent-up water was fearful to look upon even, to say nothing of man's audacity in attempting to stop its wild career. No shadow of fear, discomfiture or dismay appeared on the bronzed features of the engineers. For, if there had, it is probable that a panic would have ensued at once. It was just before a real battle, fraught with danger. These men had to go out over the awful flood 1,500 ft. from either shore. Who could say but that the dam might go when the water came up to the carwheels and sink every train on the tracks? Burning oil under the locomotive boilers roared hot words of defiance to the floods beneath; and the water hurled back derision and scorn to the roar of fire and hiss of steam, to exploding safety valves, and exhausts of monster engines and the hideous grinding of a thousand carwheels on granite grit. No such combine of noises was ever known on earth. "Go"' was a word of command. Two entire trainloads of rock hailed into the jaws of the torrent. The floods howled in rage and rose a little higher. The empties moved to shore, and two more long trains came over the gap and hurled their loads into the teeth of the dragon below. Pelee was rivaled in the art of stone-throwing and Vesuvius, for a new Gettysburg was raging. Then long trains of enormous weight, of cars called "battleships," loaded with hundreds of tons of gravel, rolled over the tempest of water. These cars are made of steel, and their sides are suspended on hinges. At the word of command both sides of both trains flared out and a rain of gravel fell, the like of which was never seen. These small stones filled the interstices between the large. This caused the river to rise faster and the awful current to increase its fury. And pressure grew apacé. At midnight a wonderful word of command was heard—"Faster!"

More oil went into the fires; steam could do no more. Pikes and bars of steel were grasped with renewed energy by many tribes and kindreds of men. Human hands could not move faster. "We must have large rocks now," was the order at 1 a. m. For rocks now began to be deflected out of a vertical line and go down-stream somewhat. "Bring the 5-ton rocks." One of these, weighing 5½ tons, was watched when it dropped. The water clutched the mass when it rolled and tumbled over similar rocks down the side of the dam 60 ft. It is still there—a witness to the momentum of running water. "More rocks!" was the incessant cry.

Behold! there was light in the east. It was dawn; the progress of time had not been noticed. More trainloads of heavy rock brought the crest of the dam up to the tracks. Then train after train of "battleships" expanded and thundered down gravel. As the sun rose, so did the river, and faster if possible came the rock and gravel. Here is the record of the battle when at its height:

One car of stone was thrown in during each interval of 4¾ minutes! This broke the world's record. The throats of Aetna and Cotapaxi may have done better at times.

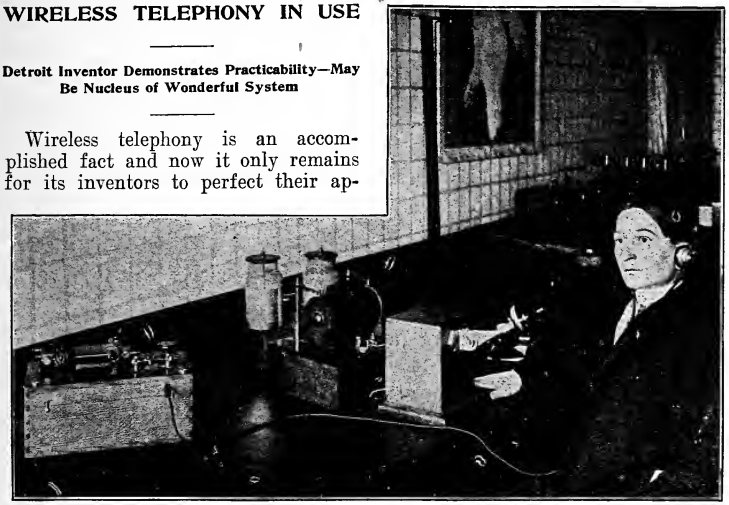
It was exact noon of Sunday, November 4th.

"Oh, look! The river is not rising," shouted some one. "The water is stationary," said another. And "it is beginning to fall," another. And then a triumphant shout, and a shout of victory, was heard in the wilderness.

WIRELESS TELEPHONY IN USE

Detroit Inventor Demonstrates Practicability—May Be Nucleus of Wonderful System

Wireless telephony is an accomplished fact and now it only remains for its inventors to perfect their apparatus and adapt it to the commercial needs of the day. The world is no longer incredulous. The rapid advancement made in the use of wireless telegraphy has swept away the doubts of even the most conservative and business men are looking forward to the time when unrestricted verbal communication between New York and London, or Chicago and Berlin, may save them a trip across the ocean.



Prof. Clark and Wireless Telephone Instruments

Thomas E. Clark, of Detroit, has produced a wireless telephone system which seems to be the nucleus of the world-connecting system yet to come. Instead of the air, as in wireless telegraphy, he uses the earth as his medium of transmission, success depending, it is said, upon sustained vibrations.

As yet Mr. Clark has tried his instrument with only two dry cell batteries and with apparatus designed for short distances. These experiments, however, have been attended with promising success. The sound was carried without loss in volume, change of pitch, or the disagreeable sonorous defects incident to the metallic circuit 'phones.

Despite this wonderful achievement, the difficulties yet to be met are great. For instance, in order for one patron to call up another in a distant city, where hundreds of telephones were in use would necessitate that the sending instrument or transmitter be given the

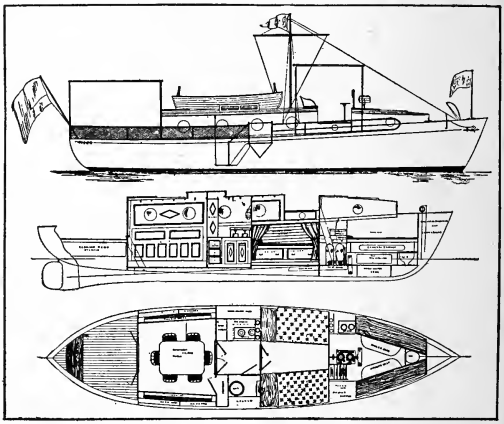
right degree of power to overcome both the distance and the varying accidental conditions which affect transmission, and be attuned to set up vibrations in the particular 'phone desired, calling the attention of the owner and enabling him to hold converse over the wireless line. The field of operation, however, cannot be limited and may eventually include any two points on the earth's surface.

35-FT. CABIN CRUISER

The plans shown are those of a very commodious little cruiser described in The Rudder. This boat is 36 ft. over all, 33 ft. on the water line, and 9 ft. 3 in. breadth. Three watertight bulkheads will be fitted, making the boat practically unsinkable.

In general appearance the boat resembles the larger type of motor yacht. Every inch of space has been put to practical use. The deck is raised forward, and the deck house is divided by a bridge coming over the forward end of the double stateroom. The motor is located forward in what is properly the forecastle, which also includes berths and toilet accommodations for the crew. Next aft of this and separated by watertight bulkhead is the owner's stateroom with berths on either side, and from this again is a passage having the galley on the port side and owner's toilet room on the starboard side. The main saloon is at the after end of the cabin and has Pullman berths folding up in the joiner work on either side, and dining table in the center. From the main saloon one enters the self-bailing cockpit, in which is the fuel tank, with a capacity of 200 gal. The bridge deck and cockpit are covered by awnings, and a 10-ft. dinghy is carried on davits on the port side. A signal mast and boarding ladders are fitted.

The motor is a 22-hp. gasoline engine. Equipment includes a generator, storage batteries, with incandescents and searchlight.



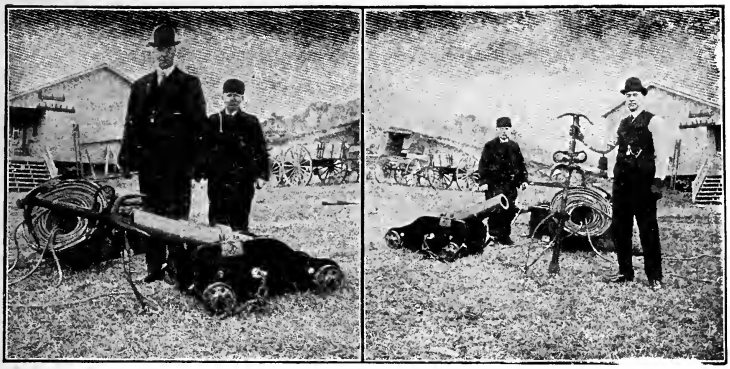
Complete Little Cruiser

QUEER VENTILATORS IN INDIAN CARS

The passenger coaches on the railways of India are using a peculiar ventilator to fan their patrons. Four wind scoops are placed on top the car, attached to a vertical shaft extending down into the car with two blades. When the car is in motion the scoops above and the blades below revolve, and also by means of gearing wind up springs which run the blades while the train is standing still. The Railroad Gazette, Calcutta, says the passengers in a compartment can regulate the operation of the fans.

An autobus line will operate between Tokyo and Kanagawa, Japan, a distance of 9 miles. Fare will be 2 sen (1 cent) per mile.

Eight bills for charters for railways to Hudson Bay are pending in the Dominion parliament.

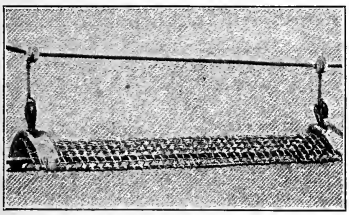


Copyright Waldon Fawcett

The above illustrations show the latest invention in life-saving projectiles. Some of the United States Life-Saving Stations have already been equipped and the apparatus is being considered by chiefs of fire departments in several large cities. The outfit is easy to carry and operate, and with a little practice the anchor can be fired through a window several stories up, or thrown over the top of the building. The flukes are certain to catch.

SAFETY TROLLEY FOR RAILROAD CROSSINGS

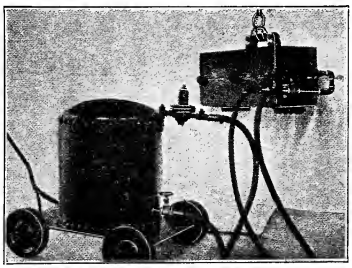
Every little while some trolley car becomes stalled while crossing the tracks of a steam road, and there are numerous cases on record where an express train has wrecked the street car because the conductor was unable to replace the trolley wheel on the wire in time to get out of the way. The Electric Traction Weekly describes a recent invention which is expected to prevent future accidents of this kind. A metal network in the shape of an inverted trough is stretched across the steam tracks close above the trolley wire. This wire netting is charged with the same current as the trolley wire and would enable the motor car to continue its passage even when the trolley wheel had jumped the wire.



To Save Wrecks

LOCOMOTIVE FIRE KINDLER

To save time and kindling in starting a fire in a locomotive, the device illustrated has been adopted on some roads. Crude oil is used in large burners with a mixture of air, the necessary pressure being supplied by compressed air carried in a tank on wheels.

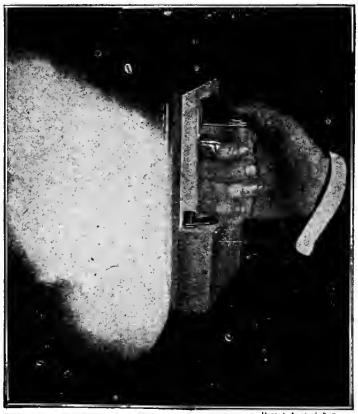


Makes a Quick Fire

Electric power from the Canadian side of Niagara Falls is now propelling the street cars of Toronto.

PRACTICAL FLASH-LIGHT HOLDER

The staff photographer of one of Chicago's leading dailies, whose original work in newspaper photography



Photographed by Its Own Flash

has attracted national attention, has invented the first really practical flash-light holder. In these days newspaper photographers have to work quickly; the managing editor cannot wait for the sun to shine, and nearly all interior views are now flashed. In working out of doors great difficulty is experienced in preventing the powder from blowing away; in making it flash at the exact moment, and in directing the light where most needed. Pictures of almost priceless value are lost daily through failure arising from one of these causes.

The device illustrated insures a good strong negative regardless of sun, wind or weather.

The powder is inclosed in thin flat bags about 4 by 5 in. which can be attached to the shield in an instant. The shield acts as a reflector and protects the operator from injury, and can be pointed up, down, or sideways, like a dark lantern. The explosion is caused by pressing a button in the handle, which makes a sure spark from miniature batteries contained in the box below. The switch is thrown on when going into action, and the button sets off the flash at the moment required. Any photographer, professional or amateur, will recognize the advantages of the new method.

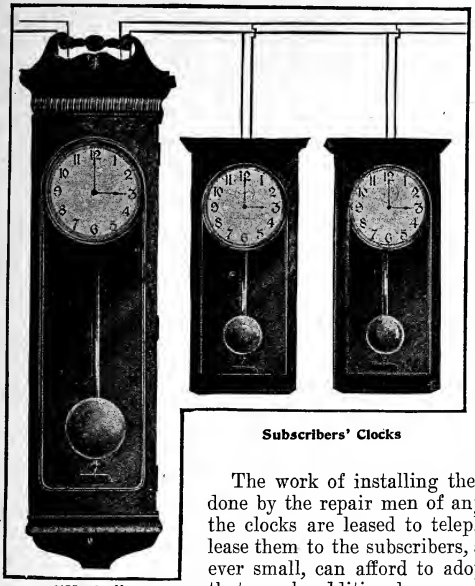
KEYLESS CLOCKS FOR TELEPHONE SUBSCRIBERS

"Central" Does All the Winding—Observatory Time for Home and Office

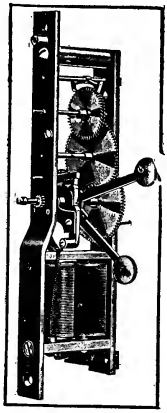
The good old-fashioned clock operated with weights or springs is being crowded out of existence in these electrical days, and is rapidly becoming a curiosity. Telephone companies are now furnishing their subscribers at a small annual rental, self-winding electric clocks that give absolutely accurate time. The clock or clocks can be placed anywhere in the house and are connected to the telephone wires by means of concealed wires. The telephone clock never stops, for it never runs down, and should it vary a second or two in the course of the 24 hours it will be correct again within a few hours, for once each day all the telephone clocks in the city are synchronized, or set. This setting is done from the central office at some hour when the telephone is least likely to be in use, say 3:00 o'clock a. m. The setting requires only a moment and is accomplished by a separate current sent over the wires from the master clock.

The operation of the telephone clock is simple and will be readily understood by the illustration, Fig. 1. The winding is done by means of dry batteries, which energize the magnet, (see cut), and cause it to lift alternately the small round weights, each one of which in falling once will operate the clock 7½ minutes.

The system is absolutely safe and the rental of a clock is about the same price as people pay for having clocks cleaned each year.



"Master" Subscribers' Clocks

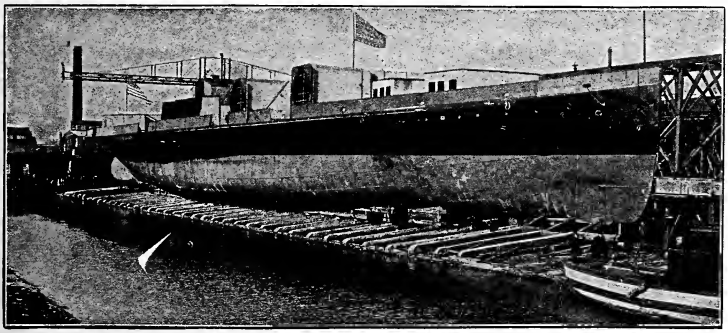


The Works

The work of installing the clocks is simple and can be done by the repair men of any telephone company, and as the clocks are leased to telephone companies, who in turn lease them to the subscribers, any telephone company, however small, can afford to adopt the system, as it yields just that much additional revenue without any investment.

LARGEST SIDE-WHEELER IN THE WORLD

The largest side-wheel steamer in the world, the "City of Cleveland," was launched at Detroit on January 5th. Her dimensions are: Length, 444 ft.; beam, 96 ft. 6 in.; and depth, 22 ft. There are seven decks with a passenger capacity of 5,000 and sleeping accommodations for 1,500. In addition, freight cargo equivalent to 110 carloads can be carried. Electric passenger

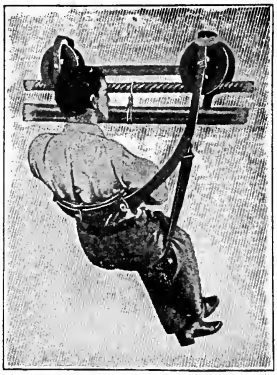


elevators connect the upper and lower decks. There is a telephone in every stateroom which will have connection with the city service when in ports. A complete wireless system will afford land communication when sailing. A speed of 25 miles is expected from the 8,000-hp. engines.

A unique feature is the bow rudder which can be seen in the illustration taken just before launching. The steamer will cost $1,250,000 and run between Detroit and Cleveland the coming summer.

SAFETY CAR FOR LINEMEN

A new safety messenger car for use of linemen is shown herewith. The



Will You Ride?

car weighs 28 lb. and the occupant can push himself along without assistance. One of the chief points of inprovement is that the workman faces his work instead of being obliged to look up, and being securely strapped to the car, he has both hands free for work.

When hanging pressed paper over varnished paper, says the Master Painter, first cut the varnish with strong sal soda water, which will remove the glaze so the new paper will adhere firmly.

SPRING MOTOR AUTO FOR CHILDREN

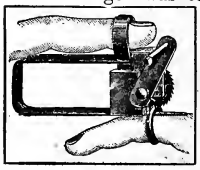
This juvenile auto, complete with pneumatic tires, horn, steering wheel, ball bearings and lamps, is now on the market for use by children. It weighs only 60 lb. and cannot travel faster

Speed 5 Miles

than 5 miles an hour. Starting and stopping is accomplished with two foot pedals. The motive power is a powerful spring which is wound up with a crank handle and is so geared that a child can wind it.

REMOVING RING FROM FINGER

The old way to remove a tight ring from a finger was to file the ring in

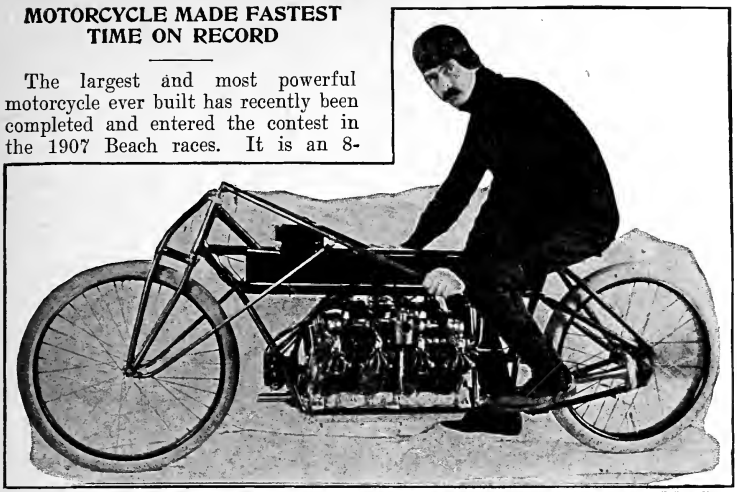


two, using a thin, sharp file and placing a narrow strip of metal between the ring and finger to protect the skin. This operation, while effective, is necessarily slow, and usually by the time such a measure is necessary the finger has become badly swollen and extremely painful.

The latest addition to a jeweler's kit of tools is a ring sawing machine, which is quick and painless. Its operation will be readily understood from the illustration.

MOTORCYCLE MADE FASTEST TIME ON RECORD

The largest and most powerful motorcycle ever built has recently been completed and entered the contest in the 1907 Beach races. It is an 8-cylinder machine of 40 hp. The record for the 10-mile race is already held by the same builders who won the 10-mile race three years ago at Ormond Beach with a double cylinder machine in 8:54 2-5. Great expectations are placed on the performance of the new machine, which is driven direct with a one to one gear, with 26-in. rear wheel. The wheel base is 65 in. The entire machine weighs 300 lb. and is faster than any other mechanical motive power ever built by man.



Courtesy C. H. Curtiss Mfg. Co.

40-Hp. Motorcycle Which Made a Mile in 26 2-5 Seconds

PEARY READY FOR A RUSH ORDER

Commander Robert E. Peary says that if he receives a rush order he will be ready to undertake another polar expedition in the summer of 1908. He claims that his last trip simplified reaching the pole 50 per cent, and still believes that sledging is the only practicable means of transportation thither. Speaking of the far north, he said:

"In the Arctic 100 days is a century, because the sun shines through one long day from March to October. Think of night constantly from October to March. The imagination is staggered! There is no time at the north pole. A phenomenon to be remembered about the pole is that there is no north, no east, no west. You can only go one way, and that is south. In the Arctic there are ice cakes as high as the capitol at Washington."

DIAMOND DIES FOR DRAWING WIRE

In the various wire factories of this country several hundred thousand dollars' worth of diamonds are used as dies for drawing fine wire to sizes less than 0.025 in. in diameter. The diamonds weigh four to five carats each, are worth from $15 to $20 a carat and are uncut except as to the die.

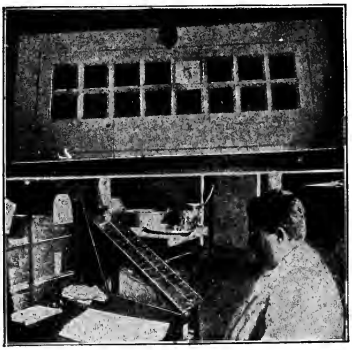
The hardest steel dies cannot be used for this purpose as the wear enlarges them so that the wire is not of sufficiently uniform diameter. With diamond dies platinum can be drawn to a diameter of five-thousandths of an

inch and in one pound of copper there are six miles of wire three one-thousandths inch in diameter.

MECHANICAL IMPROVEMENT FOR HOTEL DINING ROOMS

When a man takes his seat in the dining room of a hotel and has given the order for his meal, he usually waits patiently until he is served—unless he looks across the table and notices that the guest who came in some time later than he is served first. Then he gets mad.

Sometimes delays are unavoidable, but the new mechanical system of



"Cook Presses Electric Button When Order is Ready"

checking described in the Hotel World is expected to largely correct the trouble, and incidentally give prompter service with one-fourth less waiters. This is how it is done:

When the order—which is written on an order blank—reaches the kitchen the checker numbers it with the number of the waiter and by means of a time stamp prints the hour and minute it was received. Then it is passed along to the cooks. With the record of the time the order is received staring him in the face, even the most procrastinating cook sees no chance to lay the blame of delay on some one else. So he gets busy.

In the meantime the waiter has returned to his station in the dining room to wait upon the guests, and instead of making several fruitless trips to the cook's domain he does not start for the kitchen until he is called. This is a very simple but effective system. When the order is ready to leave the kitchen the cook presses an electric white button bearing the number of the waiter who brought the order and instantly in the dining room the same number is lighted in an annunciator. When No. 5 sees his number flash he knows there is something ready for him and he goes and brings it in. When he receives his eatables his number is extinguished by pressing a black button.

The apparatus is so simple any local electrician can install the device which should be worth many times its cost in any hotel, large or small.

THE NEW HELION FILAMENT LAMP

After having worked at the problem for several years, Prof. H. C. Parker, of the Physics Department at Columbia University, New York City, and W. A. Clark, an electrical engineer, have at last succeeded in perfecting a substance that will take the place of carbon in the incandescent lamp. They have named it "helion," and hope by means of it to reduce the cost of electric lighting to a third of what it now is. It is composed to a large extent of silicon; the other substances which go to make it up have not yet been made public. An experiment was tried on January 13th: A current was turned into two bulbs attached to the same wire. One of these bulbs was the regular 16 candlepower carbon filament variety, the other the same sized bulb but equipped with the helion filament. A slight current was turned on, the carbon filament lamp gave only a small dull red glow, while the other gave a bright glow sufficient to read by. The current was increased to 55 watts, the old lamp gradually brightened until it

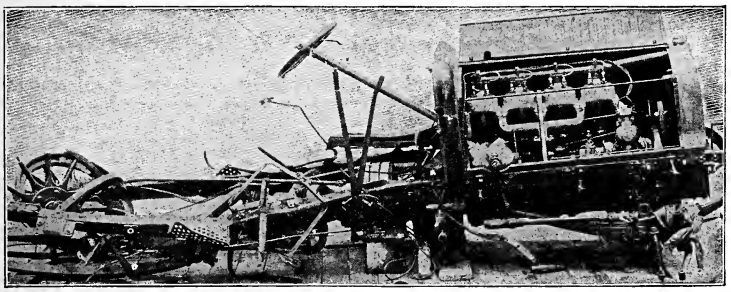
equalled 16 candlepower. At 38 watts the helion lamp was equivalent to 40 candlepower. Mr. Clark said that if the power were increased the carbon filament would break, but the other lamp would stand a great deal of overloading. Out of the few thus far tried eight lamps have lasted from 485 to 1,270 hours.

Prof. Parker said: "The lamp that ran 1,270 hours showed a rather interesting performance. It was started at 37 watts and 37 candlepower. At the end of 200 hours it began to show an increase in candlepower which increase continued until the candlepower reached 40 at 400 hours, the wattage remaining practically constant at 37. At 400 hours the candlepower began to decline and again crossed the 37 mark at 500 hours. When the last reading was taken at 1,230 hours the illumination had dropped to about 35.5 candlepower and the consumption to about 26.5 watts. We have been able to make filaments as low as 30 candlepower. We want them to get down to 20."

If this new lamp were to be manufactured right now, it would cost ten cents more than the carbon filament lamp, but it is hoped to reduce this cost. But this lamp will last twice as long as the old one, besides requiring a great deal less current.

About a year ago Dr. Siemann, a German scientist, announced that he had made a filament of tantalum. It consumed only 1.9 watts per candlepower and was called "the most startling advance in electric lighting invention since the pioneer work of Edison."

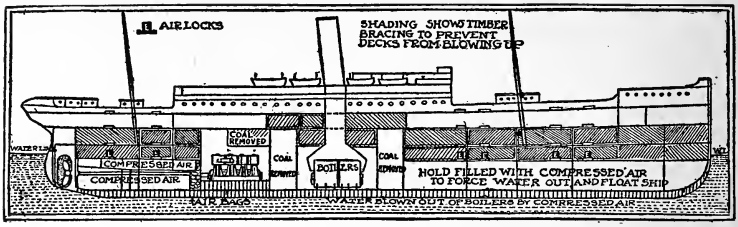
Dr. Kusel, another German, said that he had found tungsten—a rare metal—to be the perfect filament. It consumed 1.2 watts per candlepower. Prof. Parker and Mr. Clark say that 1 watt per candle has been reached in helion—not a metal—and that it can be made in great quantities.



WHEN MOTOR CAR AND LOCOMOTIVE MEET

While too many of them have suffered the fate, what a motor car that has been struck by a railway train looks like is a sight seen by comparatively few eyes. The accompanying picture will therefore satisfy some little curiosity. It portrays a four-cylinder car that has been hit by a 60-miles an hour express train. A notable feature of this particular wreck is that when it was first received at the factory for repairs the motor was tested and found to work almost perfectly despite the terrific impact to which it had been subjected.

Canada is trying to pass a bill imposing an export duty on electrical power generated in the Dominion and sold in the United States.


AIR LOCKS
SHADING SHOWS TIMBER BRACING TO PREVENT DECKS FROM BLOWING UP
COAL REMOVED
COAL REMOVED
COAL REMOVED
BOILERS
COMPRESSED AIR
COMPRESSED AIR
HOLD FILLED WITH COMPRESSED AIR TO FORCE WATER OUT AND FLOAT SHIP
AIR BAGS
WATER BLOWN OUT OF BOILERS BY COMPRESSED AIR

RAISING A 12,000-TON STEAMER

How Two Young Engineers Succeeded After Experts Failed

It was a damp, foggy night on November 1, 1905, when the Royal mail steamer "Bavarian," bound for Quebec, struck on Wye Rock in the St. Lawrence river, 38 miles from her port. The great 12,000-ton ship was alone worth one million dollars, and the next day divers went down and reported the bottom of the hull torn out in great pieces and the wreck securely impaled on the sharp rocks

One after another of the wrecking companies tackled the job, but all the various methods which had proved successful in other wrecks utterly failed with the "Bavarian." Finally the insurance companies, in desperation, began a search for men with new and untried ideas.

The announcement fell into the hands of Robert O. King and his friend, W. W. Wortherspoon, two young American engineers only recently graduated from technical schools. One of them then had a position on one of the tunnels under East river; he was also an expert diver. The two formulated a plan for expelling the water from the wreck by means of compressed air, in a manner similar to that employed in forcing water out of a caisson. The old-timers laughed at the scheme, but the young men were given permission to try. All the ship's compartments were made as air-tight as possible, the hatches were closed, sealed and fastened; and air locks were placed on the compartments which were full of water.

When all the preliminary work was done, several batteries of big air compressors were brought, anchored over the wreck and connected by flexible piping to the interior of the hull.

As the air was sent down into the hull the water was gradually forced out and on November 16, 1906, the wreck suddenly shook itself free from the rocky jaws which held it, and began to rise. As it came up through 60 ft. of water it rose faster and faster and then appeared above the surface covered with the slime of the river bottom. Tugs gathered around, made fast, and the triumphant procession steamed into Quebec with whistles blowing and flags flying.

The operations had cost only $30,000 and the salvage reward is one-half her value, or $500,000.

Brains and education had won.

ELECTRIC FENCE TO GUARD GOLD MINE

A barbed wire fence heavily charged with electricity will surround and guard a gold mine at Reno, Nev., hereafter. Recent thefts of ore led to the erection of the fence and anyone attempting to climb it will meet with instant death.

Vienna policemen, it is said, are provided with pocket telephones which they can connect in a second to the wire in special call boxes placed in all important streets.

LARGE STEAM TURBINE

The accompanying illustrations show a 10-ft. turbine in course of construction and a 27-in. turbine complete. The large exhaust shell, Fig. 1, shows the many nozzles through which the steam passes and gives some idea of the enormous amount of steam that can be converted into mechanical energy in a comparatively small space.

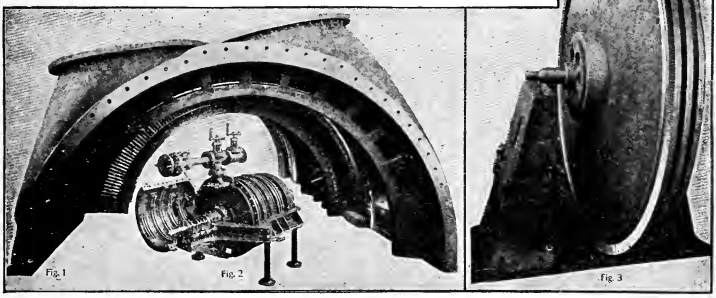


Fig. 1—Exhaust Shell Fig. 2—27-In. Turbine Complete Fig. 3—Rotor of 10-Ft. Turbine

In Fig. 3 is shown one of the 10-ft. rotors and the method of balancing. It is of extreme importance that the rotors be perfectly balanced, as the rapid revolutions when running would cause troublesome vibrations if one side were even a very little heavier than the other. The balancing is done by supporting each end of the rotor axle on a steel-rail bearing as shown. The least difference in weight will then be shown by the rotation of the rotor.

The problem of setting the numerous blades is a very difficult one, as the clearances are so small that the slightest inaccuracy will prevent the successful operation of the turbine. The

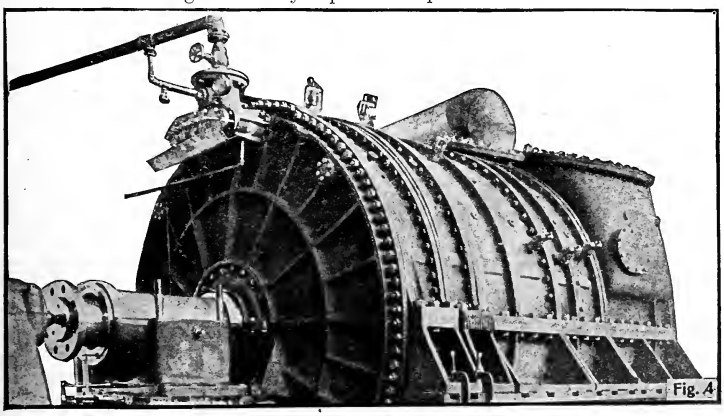
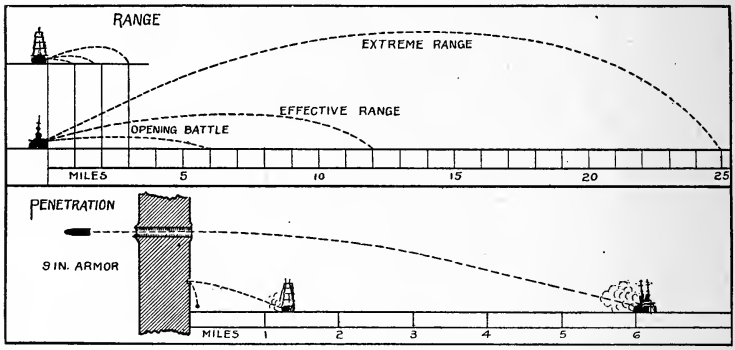


Fig. 4—Testing a 10-Ft. Turbine

loosening and detachment of a single blade is liable to wreck the entire turbine, as one detached blade in the shell would probably catch in the nozzles and tear out several other blades which would then work havoc with the remaining blades and nozzles.

The 27-in. turbine shown in Fig. 2 has the top shell removed to show the rotors.

A CENTURY'S PROGRESS IN THE ENGLISH NAVY



Will the Coming Century Do As Well?

It is exactly 100 years from the old "Victory"—considered by Nelson the most efficient three-decker, and on that account chosen as his flagship before Trafalgar—to the reigning king of battleships, the "Dreadnaught." A comparison of the two vessels affords a forcible illustration of the progress of a century in the English navy.

Quite as interesting as any of the above figures are those comparing the number of men and guns, and draft. The "Dreadnaught" with her 17,900 tons draws only 18 in. more, while she has 70 men and 67 guns less than the "Victory."

The "Dreadnaught's" extreme range is 25 miles, with a penetration of 9 in. at 6 miles. The "Victory's" extreme range was only 3 miles, while at a mile and a quarter her shot would have made only a good sized dent in our modern armor.

	"DREADNAUGHT."	"VICTORY."
Time Building	16 months	Five years ten months
Total Cost	£1,797,497	£89,000
Displacement	17,900 tons	3,400 tons
Total Weight Broadside	6,800 lb.	1,160 lb.
Heaviest Guns	12 inch	6 inch
Weight of Charge	265 lb.	10½ lb.
Time to make Gun	12 to 15 months	Four Guns a Week
Cost per Gun	£11,000	£57 15s.
Average Weight per Gun	58 tons	56 cwt.
Complement	780 men	850 men
Length	490 ft.	226 ft. 6 in.
Breadth	82 ft.	52 ft.
Mean Load Draught	26 ft. 6 in.	25 ft.
Number of Guns	37	104
Speed	21½ knots	10 knots

The omission of a decimal point on page 111 of January issue made the muzzle velocity of a shot from the "Dreadnaught" read "5 miles per second"; it should have been .5 miles.

HOW PENS ARE MADE

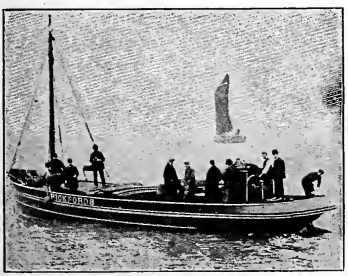
[Extracted from a lecture by Mr. Hawkes, manufacturing pen expert.]

Good steel of a uniform grade and rich in carbon is the material from which pens are made. The steel comes in sheets 19 in. wide and 5 ft. long and is imported, as American manufacturers have not yet attempted to make the higher grades of steel.

If a sheet of steel is heated red-hot and allowed to cool gradually it becomes so soft that it can be rolled, bent or squeezed into various shapes. If, on the other hand, it is heated red-hot and suddenly chilled it will become so brittle that attempts to bend will break it and a hammer blow will crush it to bits.

If the steel is heated gradually this hardness will be drawn out, and as the temperature rises the steel will become more and more tough, until at a temperature of about 575° it has the resiliency of a spring. It can be heated again to a red-heat and gradually cooled and brought back to its original softness, and the operation can be repeated over and over again without changing the chemical character of the metal.

The sheets of steel are cut into strips wide enough to permit of two pens being cut with their points interlapping. The steel is annealed to a light cherry red for a number of hours and then cooled gradually, when it is soft enough to bend easily. The scale is then removed by pickling the steel in a bath of diluted acid, and the strip is ready to be passed through the rolling mill. The number of times it must go through the mills depends upon how thin it is desired to roll it. Each strip is tested with a microchronometer gauge, and should it be too thick it is again put through the mills. If too thin, it is laid aside for the production of a pen on which a thinner steel can be used. The steel then goes to the cutting room, where the pen blanks are cut out by machines. On one side of each blank there is a little dent, which is known as the "bit," and which is used as a guide in passing the metal through a number of succeeding operations.



The small motor boat for light freight traffic on the English seacoast is rapidly taking the place of sailing craft. The illustration shows a common type of small commercial boat.

The pens are pierced by machinery, some requiring but one piercing, others two or three, the latter being more expensive. From the piercing machine the pens go to the muffle room, where the blanks are annealed. Fifty or sixty gross of them are placed in each iron pot and heated and cooled just as was the strip steel. The name is then stamped on the blanks and the pen is ready to be formed. Some pens have to be "crushed," by which process a little wing of steel is bent under them.

If the pen is still soft, it is necessary to take it to the muffle room and again heat it to a light cherry red and chill it suddenly. This process renders the pens quite brittle, so much so indeed that they can be readily crumbled between the fingers. Later on this hardness is drawn out by the process already outlined. By this time the pen has become coated with an oxide, which is

removed by scouring or by a shaking process, by which the roughness is gradually rubbed off.

The next operation is grinding, some pens being ground twice, others three times, in some cases by hand and in others by automatic machinery.

The pen next passes to the slitting room. This operation is a very delicate one, as the pen is now hard and brittle and the slit must be cut cleanly through the hard steel without damaging it in any way. After slitting, the pens go to the rounding room, where they are made perfectly round and smooth, so that no matter at what angle the pen is held the paper will be in a tangent to its surface, and there will be no possibility of sticking or scratching.

Every pen is now examined by an expert, so that the faulty pens which have accumulated in the various operations may be thrown out. This is the third examination. The pens now go back to the room in which the oxide was removed, to be polished by the shaking process before described. If they are to be colored, they are placed in a tempering cylinder and heated to the desired color. The first heat brings them to a light straw color, a dark yellow, a brown, a purple and then a blue shade being obtained by increasing the heat. If the pen is to be left white, it is, of course, not reheated.

In order to preserve the pen and prevent it from rusting, a coat of lacquer is put on by means of machines. If the pen is to be plated with copper, bronze, silver or gold, however, it goes to the plating room before the lacquering operation is begun. Plated pens are now very popular and they can be plated with almost any metal desired.

The pens are now ready to go to the boxing room, where they are "counted" by ascertaining the weight. It will be found impossible to put a gross of pens in the box intended for them unless they are laid parallel. In order to do this quickly and easily they are put in a half cylinder and shaken. This quickly places them in a parallel position, and by a very quick move of the operative they are dumped into the boxes, which are then ready to be labeled and packed.

HIGH SPEED MOTOR SLEIGH

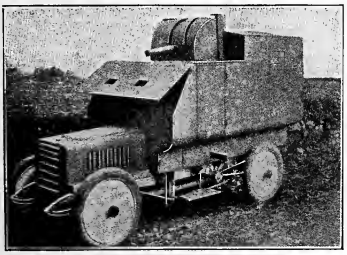
The motor sleigh is making slow progress, but will some day become a very popular form of sport. The one illustrated is 14 ft. long with runners 22 in. high. The engine drives a spiked wheel by means of a sprocket chain, the wheel being held down by heavy spiral springs. Steering is accomplished with the front runners. Very high speed is obtained on smooth ice.

SCALDING WATER USED TO KEEP TRACKS OPEN

In building the new railroad across the Isthmus of Tehuantepec, engineers encountered a difficulty not included in previous experience. The new road extends from Salina Cruz on the Pacific coast to Coatzacoalcos on the Gulf of Mexico. The country traversed is marvelously fertile and the tropical growth sprang up faster than the construction work proceeded. Boiling water was used to check the vegetation and a part of the maintenance of the line consists in frequently scalding the railway.

GERMAN MILITARY MOTOR CAR

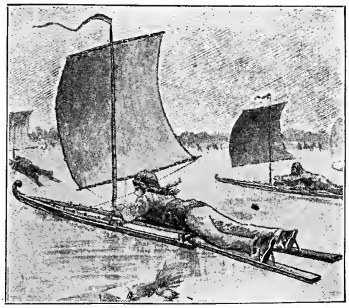
The latest armored motor-car built for the German army is illustrated below. It carries one rapid-fire gun of larger size than in any previous car. The car was built from plans largely designed by the German Emperor himself Details of the outfit are kept secret.



Kaiser's Own Plan

RUSSIAN ICE BOAT

The latest Russian ice boat is being built along lines quite different from the usual American type. The sail is



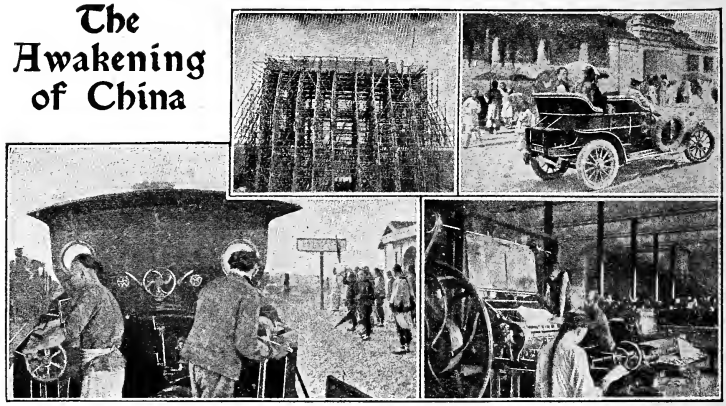
"He Rides Stretched at Full Length"

comparatively small, and the operator steers by means of two rudders, one fastened to each float, while he rides stretched at full length as seen in the illustration.

COMMERCIAL VALUE OF TECHNICAL EDUCATION

Germany leads the world in the size and excellence of its trade schools, and it is these institutions which are largely responsible for the high standard which attaches to the words "Made in Germany." Canada, which is rapidly developing manufactures, has caught the spirit of technical instruction and the government has now signified its intention to co-operate with resident manufacturers in establishing trade schools.

The Awakening of China



Mechanical Development in China--Lofty Scaffold Erected in Repairing Building Destroyed by the Boxers--State Official in Automobile--Native Enginemen--Modern Printing Machinery Operated by Natives

Western ideas, customs and methods are being adopted in China to an extent and at a rate but little realized by the rest of the world. Native Chinamen are constructing and operating telegraph, telephone and railway lines equal in results to the best European systems. To the land where printing was first an art have come the latest and fastest American presses, which are driven by electricity and worked by natives. The automobile has ceased to be a curiosity and become a utility. The army is being instructed in the most approved tactics of the world powers. Each month large numbers of students in mechanics, engineering, science, and art are returning to their own land from all parts of the world whither they have been sent to study and learn, to become instructors and constructors of the New China.

CHIMNEY 506 FEET HIGH

The highest and largest chimney in the world will be built for the smelting works at Great Falls, Mont. It will be 506 ft. high with an inside diameter at the top of 50 ft., and outside diameter at bottom of 75 ft. The chimney will be of brick, cost $200,000 and weigh over 16,000 tons, with a capacity of 4,000,000 cu. ft. of gases per minute. The interior will be lined with acid-proof brick laid in acid-proof mortar.

CEMENT CARGO TURNED TO STONE AT SEA

A strange accident befell the "Socoa," bound from a European port with a full cargo of cement for use in rebuilding San Francisco. When off the Lizard, near the stormy Cornwall coast, the "Socoa" struck a sharp point of rock, which tore a large hole in the hull and penetrated some distance. The vessel thus remained fastened as if upon a pivot.

When the salvage crew arrived to see about taking the "Socoa" from her dangerous position, the men found that water had entered the hold causing the cement to set and fix itself around the ragged rock penetrating the ship's side. The entire cargo has become as hard as stone and the ship is anchored to withstand the ages. Her rigging and upper wooden works were dismantled, but the hull remains fast to the rock.

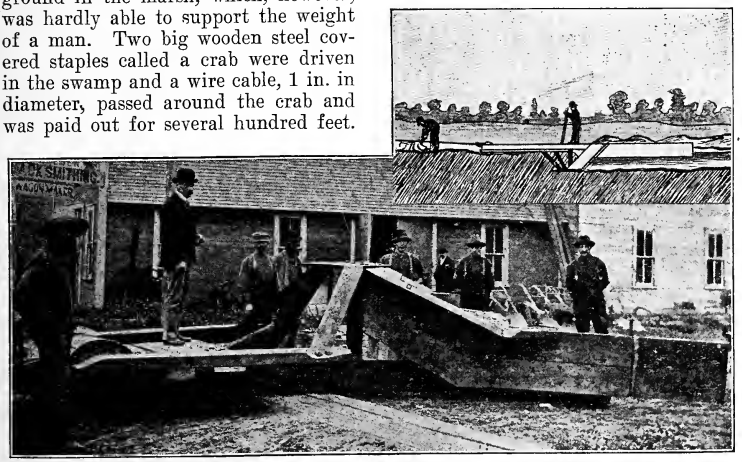
SUCCESSFUL WORK OF HOME-MADE DITCHER

Seventy Rods of Big Trench Made Per Day With 48 Oxen--Plow Turned Up-Side-Down and Transported on Its Own Rollers

Six miles southeast of Greeley, Colo., a seepage ditch was made recently by methods which smacked of those employed 50 years ago, but by means of which the cost to the owner of the ditch was only one-third as great as it would have been had he employed a modern dredger in making it.

By the combined strength of 48 head of oxen a wooden plow was dragged through marshy land making a trench 3 ft. wide on the bottom, 8 ft. wide at the top and two miles in length, into which the seepage water was drained and carried to the Platte river.

The oxen traveled on the firmest ground in the marsh, which, however, was hardly able to support the weight of a man. Two big wooden steel covered staples called a crab were driven in the swamp and a wire cable, 1 in. in diameter, passed around the crab and was paid out for several hundred feet. The cable then passed over a pulley fastened on the front end of the "ditcher" or plow and the other end of the cable was attached to an evener, to which the cattle in pairs were yoked with chains. As the four dozen animals walked, the big plow ripped up the sod at a great rate as it was dragged up to the crab, which was then moved ahead and the operation repeated. Two heavy wheels are arranged on the top of the crab and when necessary to remove it from place to place the crab is turned upside down and pulled by oxen to the desired location. A man sat on the plow to keep its big



Ditcher Up-Side-Down Being Drawn on its own Rollers

Completed Ditch

knives clear of debris and the outfit dug 70 rods of ditch a day. The picture of the plow shows it upside down, in which position it can be transported from place to place on its own rollers.

HIGH-GRADE STEEL FROM SCRAP IRON

Probably the greatest discovery that has been made in the steel industries in recent years is the manufacture of high-grade tool steel direct from ordinary scrap iron by means of the electric furnace. In one of the steel works in Germany the process has been in operation since February, 1906, but has until recently been kept a secret.

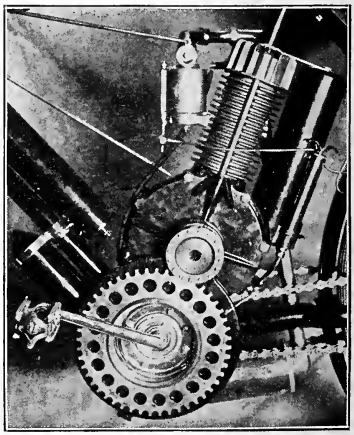
While the cost of materials for making crucible steel is from $20 to $80 a ton, the cost of the old scrap and rubbish used for electric steel averages only $12 a ton.

The rubbish is first melted in a tilting furnace or oven, constructed similarly to those ordinarily used in our American smelting works. After being thoroughly reduced to a fluid state it is poured and conveyed in a retort by a traveling crane to the electric oven, which has a capacity of from 1½ to 2 tons. In this oven the necessary quantities of carbon, manganese, chrome, silicum, nickel, tungstate, arsenical iron, etc., are added, to produce any kind or quality of steel desired. The whole process of production takes from 2 to 2½ hours.

Not only is the electric process much cheaper, but the electric steel surpasses greatly that of any crucible steel ever made, both in quality and chemical purity. By this process the steel is freed and kept clear of all gas and bubbles, which has never been possible by the old methods. Electric steel is more easily worked because of its superior purity, and permits the introduction of from 20 to 30 per cent more carbon than in the crucible steel. It can be forged easier, is not easily affected, like the crucible steel, by the damaging influence of overheating; it is stronger and offers a much greater resistance to wear and tear.

NOVEL ROLLER GEAR FOR MOTORCYCLES

Undoubtedly one of the most radical changes that have been made in motorcycles for the season of 1907 is the entire elimination of the short motor drive chain, that was most given to stretch and wear. In its place there has been substituted a roller gear drive which is simplicity itself—merely a roller pinion gear affixed to the drive shaft of the motor and which engages with a hardened steel gear wheel or sprocket mounted on the countershaft cup, the sprocket embodying the Indian brass friction or compensating rings, which are of double the usual size.



New Roller Gear

The roller pinion consists of fourteen hardened steel rollers mounted on hardened pins which are held in place by one ring and so arranged that any pin or roller may be replaced in no time at all. Both the roller and its engaging sprocket are enclosed in a dust-proof gear case and continuously run in an oil bath. As will be seen from the accompanying photograph the whole idea is wonderfully simple and well executed and presents a neat and compact appearance without sacrificing strength.

The above illustration shows one of the three-wheeled delivery motor cars used by the Evening News, London, for the rapid distribution of its papers about the city.

ELECTRICITY FOR SURGICAL OPERATIONS

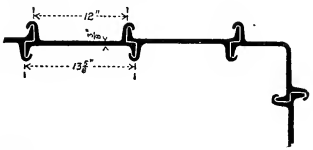
Dr. Tuffier, of the Beaujon Hospital, Paris, announces a successful use of electricity in producing a sleep of insensibility, which can be maintained, and in the administration of which the heart is not affected. He is hopeful it will do away with anesthetics.

SMELLING FOR A LIVING

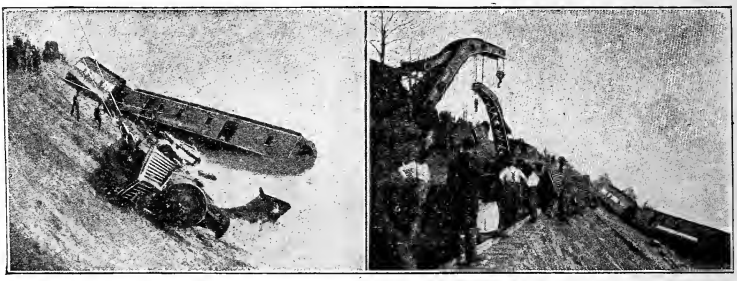
A new occupation has been developed in London and already is being successfully worked. The requirement is a sensitive sense of smell, and a little practise makes the detector quite proficient. He inspects the gas pipes and fixtures of a building and charges 18 cents for each leak he discovers. Some of the men earn $15 per week.

INTERLOCKING STEEL SHEET PILING

The latest thing in steel sheet piling for cofferdams, caissons and foundation work is a modified form of I-beam the flanges of which interlock with each other. Piles with web ½-in. thick



weigh 40 lb. per square foot. A hole is punched in the end of each pile for the insertion of a hook in pulling the pile out if desired.



WORK OF THE WRECK-CLEARING CREW

No army or city fire department has a better organization than the wreck-clearing crew of a large railroad system. In these days a small number of men are required as compared with a few years ago, for a few experts with steam cranes can do in one hour what formerly required 50 or 100 men an entire day. The crew are given other work, but not far from the wrecking car in which steam is kept up constantly; and a call to go out can usually be responded to in 15 minutes during the day or 30 minutes at night. The train usually consists of one locomotive and four cars; the crane car, one for ropes, tackle and tools, one with extra trucks, and the boarding car equipped with kitchen and dining room and constantly stocked with food supplies, not only to serve its own crew but a large additional force if necessary. A modern wrecking crane will lift from 75 to 100 tons.

KNOCK-DOWN BARRELS

At last a practical knock-down barrel is available, and they are now being made in large quantities and shipped to the West Indies and Central America. They will return filled with pineapples, bananas, other tropical fruits and vegetables. The barrels are regular size but first made in longitudinal halves, in which shape they are "nested" for shipment, the parts of 10 barrels occupying only the space required for one barrel when erected. The barrel is preferred for shipping because one man can roll one where two men are required to lift a box containing the same weight.

The illustrations from the American Exporter show the process of assembling the parts, which can be done with cheap labor.

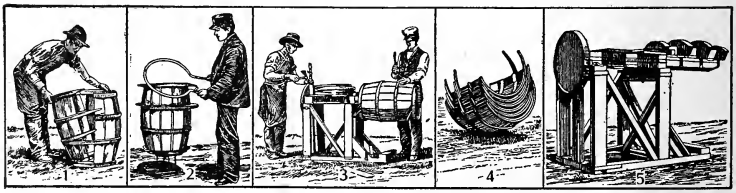
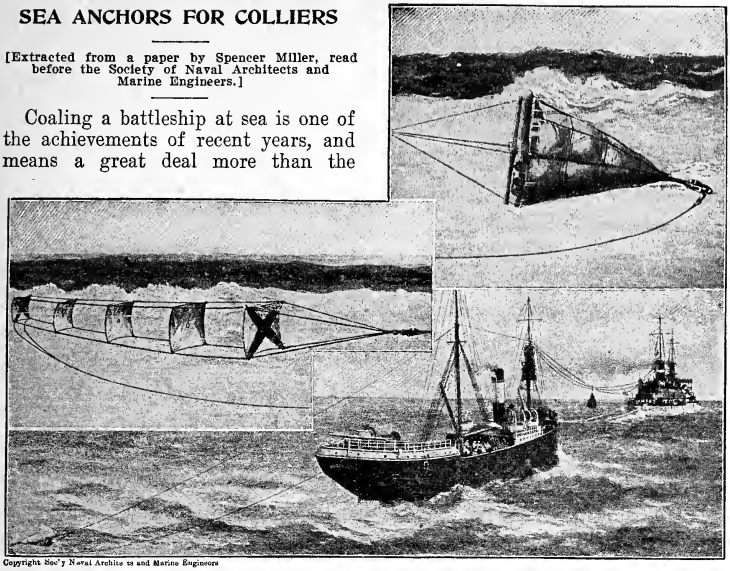


Fig. 1—Setting up the two Halves. Fig. 2—Clamping the Barrel Together. Fig. 3—Making the Burlap Hoop and Nailing the Barrel Together. Fig. 4—Barrels Nested for Shipment. Three in a Bundle. Fig. 5—Form for Nailing Barrels Together.

SEA ANCHORS FOR COLLIERS

[Extracted from a paper by Spencer Miller, read before the Society of Naval Architects and Marine Engineers.]

Coaling a battleship at sea is one of the achievements of recent years, and means a great deal more than the



Copyright Soc'y Naval Architects and Marine Engineers

New Sea Anchor at Left--Old Type Sea Anchor at Upper Right--Collier in Tow of Battleship which is Coaling in Mid-Ocean--Collier has her Sea Anchor out

average reader would suppose. Without fuel these sea-monsters are more helpless than the clumsiest little fishing smack, and would immediately fall an easy victim to the enemy. The time spent and the fuel consumed in making a coaling port and returning to her former station might easily spell defeat; hence great coal ships now accompany all naval fleets in times of active service.

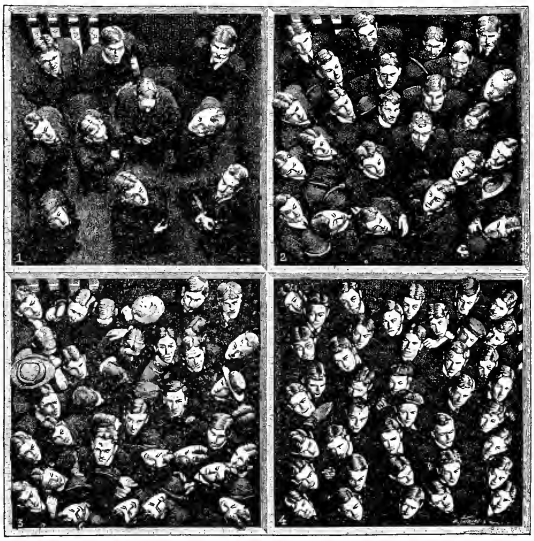
As the two vessels cannot make fast to each other on the high seas a system of aerial tramway has been used to convey the coal in bags or buckets from one ship to the other. This is accomplished by means of immense towing lines from stern of battleship to bow of collier, while the cableway leads from the mastheads. To keep the cableway taut a wire rope is passed from the collier's foretopmast to maintopmast, and then over the stern for 1,700 ft. At the end is fastened one or two sea-anchors as required. These sea-anchors are from 5 ft. to 9 ft. in diameter at the mouth and taper to a point. They are really great canvas bags with sufficient cork attached to float them; and exert a pull ranging from 102 lb. for a 5-ft. anchor at a speed of 1 mile per hour up to 65,240 lb. for a 9-ft. anchor at 14 miles. An anchor pull of 12,500 lb. is required to support buckets carrying 1-ton loads.

What is termed the new or multiplane sea-anchor seems likely to supersede the conical, which has a faculty of diving, turning and getting all "balled up" at the most inopportune moment. The new anchor consists of five 4-ft. canvas squares, weighs 325 lb., exerts a straight and steady pull, is easily launched and recovered, and altogether is much better behaved.

A perfect vacuum is a perfect insulator, although a partial vacuum conducts electricity much better than air at atmospheric pressure.

WHAT SPEED COSTS

In order for the big Cunard liners to gain their 1½ knots greater speed than the "Kaiser Wilhelm II's," Germany's fastest ship, necessitated the following extra equipment: Six boilers, 68 furnaces, over 52,000 sq. ft. of heating surface and the development of 30,000 additional horsepower. The increase in dimensions necessary is: Length, 78½ ft.; breadth, 16 ft.; depth, 4 ft.; displacement, 12,000 tons. The use of turbines, however, eliminates many difficulties.



WATERWAY MONTREAL TO NEW YORK

A Canadian company with $8,000,000 capital proposes to join an American company in establishing an all water route between Montreal and New York city. In connection with this work the Canadian company plans a 100,000-hp. power plant to utilize a water power near Montreal.

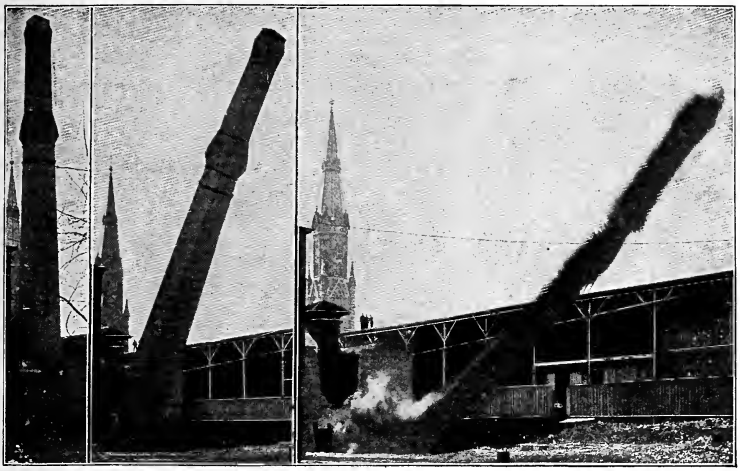
THE WEIGHT OF A CROWD

French and American engineers differ in their estimate of the factor of safety in public halls and other constructions to be occupied by standing crowds. Prof. Johnson, of Harvard, in 1904 estimated the maximum load at 160 lb. per square foot.

In the discussion of two years past, experts of several countries placed the weight at widely different figures, ranging all the way from 40 lb. to 143½ lb. per square foot. This led Prof. Johnson to make additional experiments, which he did by constructing a wooden case with a floor area of 36.25 sq. ft. The compartment rested on scales for accurately weighing the loads. The four illustrations show: Fig. 1, 10 persons weighing 1,462 lb.; Fig. 2, 20 persons weighing 2,915 lb.; Fig. 3, 37 persons weighing 5,372 lb. In Fig. 4 are 40 persons crowded into the same space with a total weight of 5,800 lb., and presents a condition such as commonly occurs when great crowds gather, as on the occasion of parades, or in those portions of halls where standing room is allowed.

At present no builder would think of erecting a residence for sale without hardwood floors. The rapidly advancing price of hard wood, however, and the constant labor necessary to keep such floors presentable are likely to greatly reduce its use. In many banks, offices and public places the hardwood floors are being covered with linoleum.

BRINGING DOWN A 165-FT. STACK



Courtesy of Henry Bacstrin & Sons

Three Stages of the Falling Chimney

The 165-ft. brick stack which 30 years ago was the tallest structure in Milwaukee was recently razed to make room for a new plant. The stack weighed 505 tons, contained 184,000 brick and was 10 ft. 6 in. square at the base. On account of boiler rooms and other buildings on three sides it was necessary to drop the stack within a comparatively narrow space, and to tear down from the top meant loss of the bricks.

The chimney was first undermined on one side, 20 jacks being placed to support the load, then the jacks were removed one at a time and oak timbers substituted with a greased skidway at the bottom. When all was ready a cable and windlass withdrew the skid. The stack remained intact for one-third the distance to the ground, as seen in the second view, then broke off about 40 ft. from the top, as shown in the right hand view; the upper section struck the ground perceptibly later than the lower section.

TARRED GRAVEL FOR ROADS

A new elastic road covering is being tested in Switzerland with gratifying results, it is said. Fine gravel is freed of all earthy matter; then, in a special machine, heated and every particle coated with tar. It is then put up in heaps and left for from eight to ten weeks, fermentation occurring in the meantime, causing the tar to penetrate the pores of the stone. This macadam is put on the roads in dry weather, using no water in smoothing it down with steam rollers and observing great cleanliness in handling it. For 28 bu. of gravel only 44 lb. of tar is required. A road was tested with a six-horse wagon, loaded with ten tons, to the satisfaction of all concerned.

Wireless Telephonic Communication has been held between Berlin and Nauen, Germany, a distance of 24 miles. It is said that the conversation was perfectly intelligible and also, that the field of successful operation will be illimitable. A microphone was used in connection with wireless telegraphy apparatus.

Search for the North Pole will again be undertaken by Commander Robert E. Peary, he says, but this time he will direct the expedition from the ship or winter quarters, at the north end of Grant Land, sending out sledge parties to cover the intervening 450 miles to the Pole.

The English Channel Tunnel is the next great engineering work in prospect. A bill providing for a submarine railway, lighted and operated by electricity, between Dover, England, and the French shore will be brought up before the British parliament at its next session. The project involves an expenditure of $80,000,000.

Milk Bottle Exchange.—Milkmen frequently get bottles belonging to other dealers than their own. At the exchange the milkman receives one cent apiece for these bottles and may obtain his own company's bottles at two cents each.

Engineering Needed at Cornell.—It seems a surprising though sad commentary that a club house costing half a million dollars, and occupied by embryo engineers, should burn and cause the death of seven men. While these students were passing severe examinations on tensile strengths of beams, and safety factors in bridges, many of them were sleeping in a fire trap.

Motor Trucks in St. Bernard Pass.—The monks of the famous St. Bernard Pass now use motor trucks instead of dogs and horses, as of old, to bring their supplies from the valley to the monastery on the mountain heights above the snow line. The authorities, however, fearing the autos may scare horses on the narrow pass, have ordered the monks to hitch horses to their cars.

Christmas Gold Coins.—The demand for gold coins is so great at Christmas time that the government mints are busy weeks ahead of time preparing for it. Many persons send gold coins as gifts and many firms pay off in gold at that time. Eagles, five-dollar and two and a half-dollar pieces are called for most.

The Manufacture of Real Diamonds as claimed by a French chemist consists of packing pure iron and pure charcoal in a carbon crucible, heating it in an electric furnace to 700° F., then plunging the crucible into cold water. The outer surface of the mass solidifies first and by the process of solidification of the liquid iron within, the carbon is squeezed out like water and crystallizes into diamonds.

Cape Cod Canal.—At last a short cut from Boston to New York by water seems probable. The project is to cut a canal from Buzzard's Bay on the south to Barnstable Bay on the north, a distance of eight miles. The channel would be 125 ft. wide at the bottom, 250 ft. wide at the top, with a depth of 25 ft. at low water. The canal will take three years to build, cost $10,000,000 and shorten the outside water route from Boston to New York by 120 miles, or about six hours.

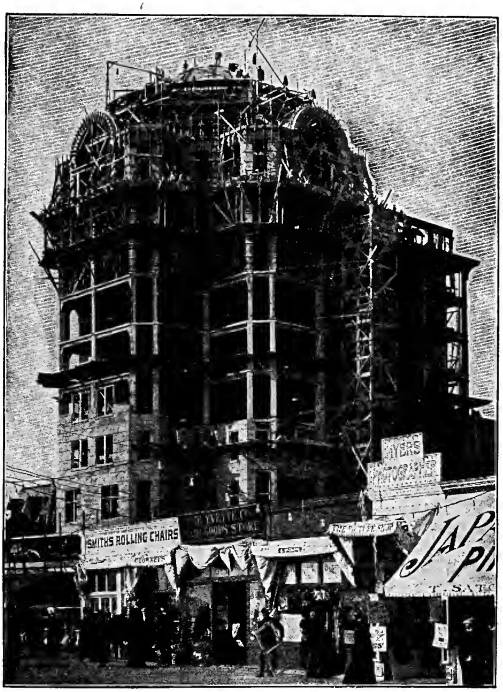
Railroad Accidents and Operation.—The accidents to passenger trains during the past few weeks in which two disasters alone cost over 100 lives, emphasize the force of our statement in a recent issue. We quoted from sources which cannot be questioned, that the percentage of fatalities is more than twice as large as ten years ago. In the two big wrecks recently, had steel coaches instead of flimsy wooden shells been used the number of killed would certainly have been greatly reduced.

BIG FIREPROOF HOTEL BUILT OF CONCRETE

A 12-story fireproof hotel has been built at Atlantic City in which no wood is used except for part of the interior finishing; the structure proper is concrete, tile and steel.

The first pile for the foundations was driven on September 10th and on December 15th the concrete roof was completed. The framework is structural steel and the walls and floors are reinforced concrete. A concrete dome three stories high surmounts the building.

In the work, rapidity of construction, economy, exterior appearance, fireproofness and the avoidance of undue noise were important considerations. These were believed to be well met by the combination of reinforced concrete and hollow tile construction.

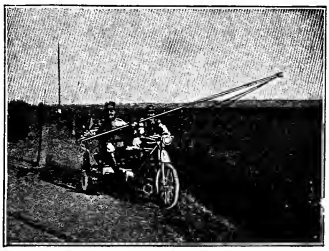


Courtesy Trussed Concrete Steel Co.

Built of Steel and Concrete

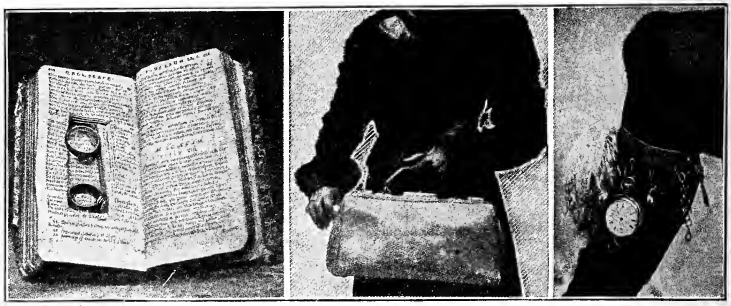
MOTOR CAR FOR ARMY TELEGRAPH CONSTRUCTION

The signal service of the Austrian army have adopted a 3-wheel motor car for emergency telegraph and telephone construction. One man operates the car while the other feeds out the wire from a reel fastened in front of him. A pole with a U-shaped guide at the end is used to raise the wire or when held horizontally deposits the wire along the side of the road. The system is said to enable a more rapid construction of lines than has ever been attained in any other way.



Stringing Wire

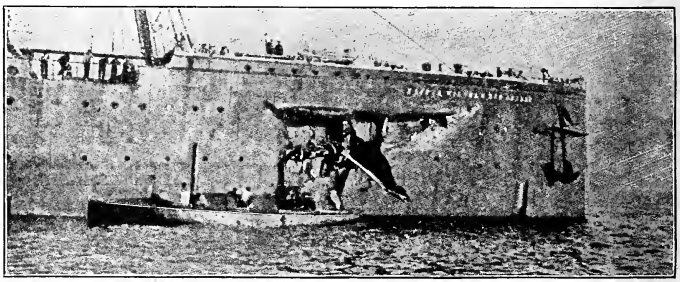
INGENIOUS SHOP-LIFTING APPARATUS



Book with Spaces for Jewels--Dummy Hand Bag with Secret Compartment--Garters with Goods Hung on Hooks

The art of the shop-lifter has been reduced to a science in which many mechanical devices are employed to facilitate the work and conceal the stolen goods. The London police recently made an arrest of a female expert who was literally covered from head to foot with evidences of theft, and without any one of the several dozen articles being visible to the keen-eyed store detectives.

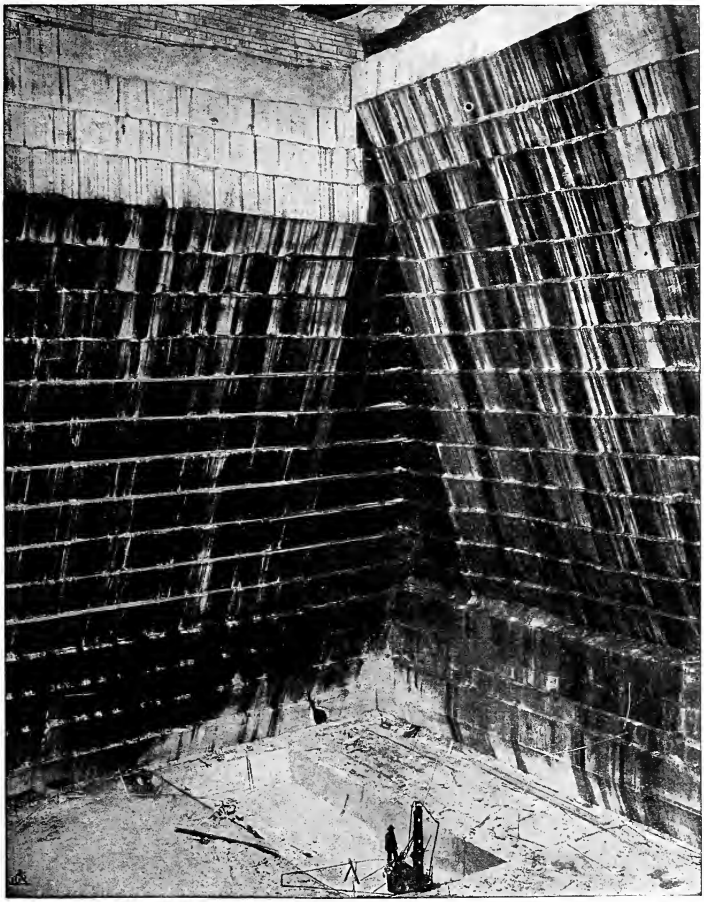
In her hair were valuable pieces of small jewelry; under the skirt was a well filled bag easily reached through a false pocket; a book carried under the arm had been prepared with spaces to hold rings and gems; a dummy hand satchel had a trap door at one end held shut by means of a spring. Her garters were sewed with spring hooks and clasps for hanging various articles; a slit in the skirt enabled easy access, while a piece of wax attached to the sole of the shoe next the heel enabled the picking up of jewelry after it was dropped to the floor. What appeared to be an innocent cuff ornament was really a spring-clip that dexterously picked up articles on the show case while the hand was in full view. On the person of the shop-lifter described were found 47 articles having a total value of several hundred dollars—the result of one day's operations.



THE "KAISER WILHELM DER GROSSE" after the collision with the "Orinoco" off Cherbourg. Some 60 sq. yds. of the "Kaiser Wilhelm's" bow were torn away; the damage amounting to $200,000. Five passengers were killed and one injured. That the results were no worse is surprising.

QUARRYING MARBLE IN GEORGIA

Georgia marbles are being used in all parts of our own country as well as exported to Europe and Canada. The yearly production of these works is very large, a single quarry taking out as high as 500,000 cu. ft. The marble is cut by means of stone channeling machines, gadders and rock drills. Machines of latest improvement have cut as high as 21 ft. 8 in. in 20



Courtesy Sullivan Mchy Co.

Quarry from which marble has been removed to a depth of 175 ft. Note the manner in which the corner and sides have been cut back into the hill by the Swivel Head Channelers.

minutes, which would be at a rate of 650 sq. ft. in a 10-hour day. For ordinary machines, however, 80 to 90 ft. is considered a good day's work of 7½ hours.

Frequently the high grade marble extends under a hill with cheaper stone overlaying. In such cases the practice is to cut back into the hill as the excavation grows deeper, leaving an overhanging wall such as is shown in the illustration.

AFRICA PROMISES GREATEST ELECTRICAL UNDERTAKING EVER ATTEMPTED

Transmission 600 Miles at 150,000 Volts Planned

Darkest Africa will soon become the lightest place in the world if the stupendous undertaking now planned is carried out. The Victoria Falls on the Zambesi have a breadth of 5,400 ft. and a drop of 330 ft., with millions of horsepower going to waste daily as the waters plunge into the gorge below.

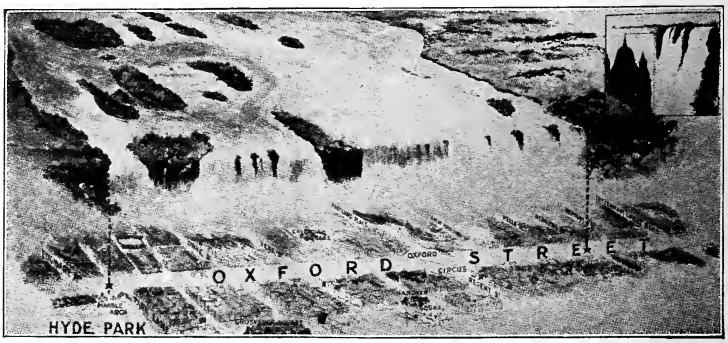
The plan is a daring one and contemplates long distance transmission of 600 miles, which is nearly four times the longest transmission line at present, with a voltage of 150,000 carried on bare cables. The present chief market for power would be Johannesburg.

The initial construction contemplates a power house of 50,000 hp. at the bottom of the gorge just below the falls.

When the local agents of the Zambesi power company in Chicago and other large American cities are selling current transmitted by wireless from Victoria Falls it will cause no greater wonder then than wireless telegraph does now; and the power transmission is really a more likely accomplishment than the telephone seemed not many years ago.

HOLLAND'S HARMLESS SUBMARINE

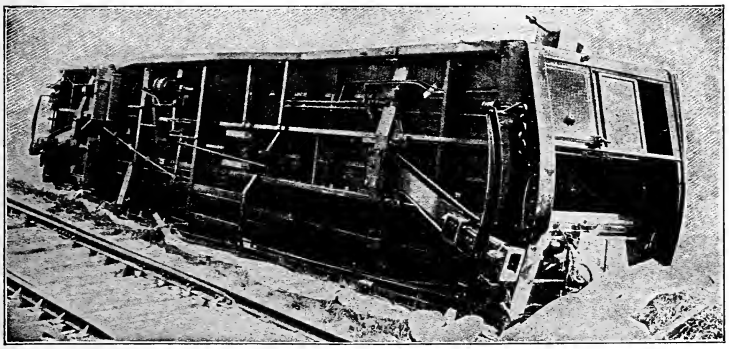
Holland, the well known authority on submarines, announces his expectation to shortly complete plans for a new craft which will not be a destroyer but will win by putting a vessel out of commission without loss of perhaps a single life. He declares it "will be the real thing in submarines, and the chief instrument in doing away with wars." All of which has a very pleasing and Utopian sound.



Victoria Falls, 5,400 Ft. Wide Compared With Oxford St., London

STEEL PASSENGER CARS BOUND TO COME

"It is true that present passenger coaches are somewhat longer and much heavier, and will resist impacts that would have wrecked cars built ten or fifteen years ago. It is true, also, that they are operated at much higher speeds, and while it may seem a broad statement, our average passenger coach today is relatively no stronger than the cars of our forefathers. If this is doubted a perusal of the newspaper reports of a few wrecks in late years will suffice. For high-speed service it is practically essential to use a steel car, if the safety of the passengers is desired. The splinters from the old wooden warships in time of action killed more men than the cannon balls. We have been over the Spanish fleet scare for some years and do not expect anyone to fire 13-in. shells at our cars, yet in a collision the conditions are not dissimilar. The force of impact will splinter the sills, posts and side plates, and a passenger caught in the wreckage has not much chance, particularly with the addition of fire. In the steel car the passengers may suffer contusions, but these are cheaper, from a claim department standpoint than an amputated limb. Aside from the question of accidents, steel passenger cars should be a good investment. The repairs are less; the life much longer; and the cost and weight of a steel passenger coach very near that of a wooden car built to the same specifications."—J. F. MacEnulty before the New England Railway Club.



Steel Passenger Car After Wreck—Note Its Good Condition

Steel freight cars have now been in use about eight years. Of 225,000 freight cars ordered from nine of the car builders in 1895, two-thirds were steel. The steel freight car was first built to enable the carrying of loads unsafe in cars constructed of wood. Soon it was found the repairs were greatly less than on wooden cars, and that a steel car could go in a wreck and be repaired for $50 which would have absolutely destroyed a wooden car.

One instance will illustrate this point: Several cars, each containing 50 tons of ore, ran three miles down a 4 per cent grade, and with the engine jumped over the end of a switch-back, the cars and engine going by actual measurement 422 ft. before striking the ground; the point of contact was frozen ground, the drop being 53 ft. from track level. The engine and cars then rolled 516 ft. The cost of repairing the bodies of these seven cars was only $350 each. A

wooden car under similar circumstances would have been nothing but kindling wood. There would have been the usual bonfire to recover a few dollars' worth of truss rods, grab irons, etc.

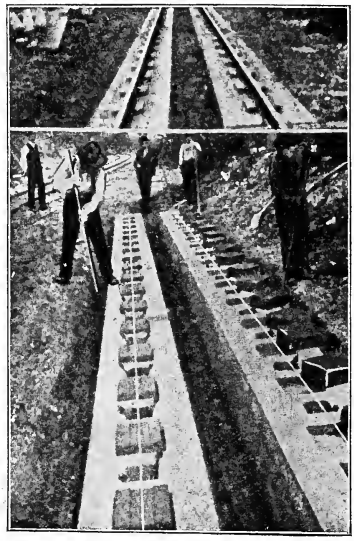
A wooden passenger coach today may be likened to a man-of-war of a century ago, when the flying splinters killed more men than bullets and cannon balls. The battleship of today is planned to avoid the use of wood wherever possible, and when one goes into action the decks are cleared of everything which can possibly be removed.

In the wrecks of passenger trains of the past few years, the greatest loss of life has not been from cars rolling down high embankments, nor going through bridges to a watery death; but on level ground, where the helpless victims have been burned to death before the eyes of lookers-on, who were helpless to render aid.

How much longer will this condition be allowed to continue?

NEW CONCRETE BASE FOR RAILS

For several years past many street railways in England have laid their rails in longitudinal beams of concrete instead of on wood cross-ties. The same method was also used in Detroit to some extent. In both cases the base of the rail was embedded in the concrete while soft and when it hardened the rail was literally fastened as solid as a rock.



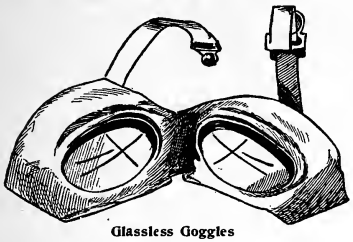
Concrete Track Base

An adaptation of this system is described in Municipal Engineering. The longitudinal concrete base is used, but at frequent and regular intervals square holes are left in the top. Into these holes, blocks made of hard burned vitrified clay are inserted, the top of the block being grooved to fit the base of the rail and hold it. Blocks of wood may be substituted and the rail spiked as on a cross-tie. After the rail is in place tar is poured to fill the cracks and prevent the admission of water.

GLASSLESS GOGGLES

Glassless goggles for automobilists is the very latest in the novelty line, a French eye specialist having hit upon the idea in eye protection which, it is claimed, will eliminate the disadvantages of the present type. Instead of glass the lenses are made of thin sheets of steel, in each of which are three narrow slits, one being cut horizontally, intersected near the nose by a perpendicular slit, the junction of the two slits forming a right angle. Below the horizontal slit is another slit, which is cut a slant toward the outside of the lens. The efficiency of these slits is based upon the scientific principle that an opening of a small diameter has the same effect upon the lum-

inous rays as the central point of a convex lens. If the eye is placed near to the opening the angle taken in is very



Glassless Goggles

large and proportionate to the diameter of the opening. The vision obtained through the slits is claimed to be brighter and sharper than through ordinary goggles, while blurred sight caused by rain, mud, dust and steam, is entirely eliminated. It also is impossible for flying stones to break them as with goggles with glass lenses. From a medical point of view the new goggles prevent swelling and conjunctivitis.

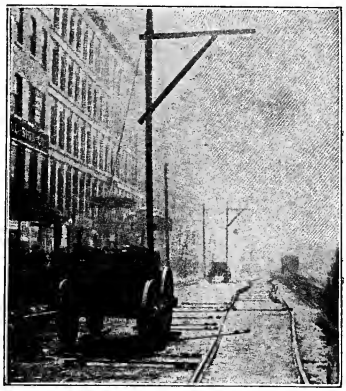
A NEW DETACHABLE SPROCKET CHAIN

The illustration shows the evolution of a new detachable sprocket chain, which is so designed that it can be made from flat stock by punching and forming in a single machine. The stock enters the machine from one side in the form of a long steel ribbon and emerges from the opposite side in the form of finished chain, ready for hardening. As the chain leaves the machine it is automatically wound on a large reel, controlled by an ingenious feed mechanism, which winds the chain as fast as it is made.

ELECTRIC ROAD BUILT IN A NIGHT

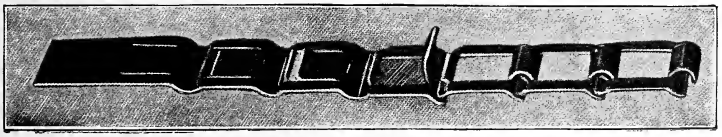
In a frantic effort to get an electric line 2,000 ft. long in operation before an injunction could be issued, a street railway company in Cleveland constructed the most unique trolley line ever seen.

The track was laid on top of the pavement, no ties being used, and the rails held in place by iron braces. To dig holes and erect trolley poles would



A Mushroom Track

have required several days, so 4 by 6-in. planks built in the form of a gallows were used for poles. The bottom of the "pole" rested in a barrel of cinders and each pole was tied and guyed to a wagon loaded with stone or sand. The scheme was clever, but the injunction arrived just in time to put the road out of business before the first car could be run. There were four other tracks already on the same street.



New Detachable Sprocket Chain

LEANING SKYSCRAPERS

Consternation prevailed for a time recently among the hundreds of occupants of a Chicago skyscraper when the discovery was announced that the 17-story structure was 14 in. out of plumb. Fears were allayed by the city building department's statement that the structure had been in that condition for months.

Inquiry disclosed the fact that not a skyscraper in Chicago which is a year or more old but is more or less out of plumb owing to the yielding character of the earth underlying the city. An inspection is made every two months and records carefully tabulated by city inspectors.

UTILITY OF THE SEISMOGRAPH

The seismograph, that intensely sensitive recorder of vibrations in the earth's crust announced in many widely remote parts of the world a recent earthquake in Chile, hours in advance of any telegraphic news. These records are extremely interesting, and valuable as a matter of history, but have not thus far been of any particular utility.

The director of the observatory at Laibach, Austria, now suggests a very practical use. He calls attention to the fact that the roof of the Charing Cross railway station fell without warning the day after the observatory in his charge reported a great earthquake; and he recommends that hereafter when severe shocks are recorded that examination be promptly made of all large buildings which might be affected by the disturbance.

1907 MOTOR BOAT RACE

The racing event for motor boats this year will be the long distance race from New York to Bermuda, a distance of 778 miles. The start will be on June 8 under the auspices of the Motor Boat Club of America. Boats must not be less than 39 ft. length nor more than 60 ft.; carry a small sail, five men and stores for 30 days.

THE 40 STYLES OF CHAIRS

There are 40 distinct styles of chairs embracing the period from 3000 B. C. to 1900 A. D.—nearly 7,000 years. Of all the millions of chairs made during the centuries, each one can be classified under one or more of the 40 general styles shown in the chart. This chart was compiled by the editor of Decorative Furniture. The Colonial does not appear on the chart because it classifies under the Jacobean and other styles. A condensed key to the chart follows:

Egyptian.—3000 B. C. to 500 B. C. Seems to have been derived largely from the Early Asian. It influenced Assyrian and Greek decorations, and was used as a motif in some French Empire decoration. Not used in its entirety except for lodge rooms, etc.

Grecian.—700 B. C. to 200 B. C. Influenced by Egyptian and Assyrian styles. It had a progressive growth through the Doric, Ionic and Corinthian periods. It influenced the Roman style and the Pompeian, and all the Renaissance styles, and all styles following the Renaissance, and is still the most important factor in decorations today.

Roman.—750 B. C. to 450 A. D. Rome took her art entirely from Greece, and the Roman is purely a Greek development. The Roman style "revived" in the Renaissance, and in this way is still a prominent factor in modern decoration.

Pompeian.—100 B. C. to 79 A. D. Sometimes called the Grecian-Roman style, which well describes its components. The style we know as Greek was the Greek as used in public structures. The Pompeian is our best idea of Greek domestic decoration. Pompeii was long buried, but when rediscovered it promptly influenced all European styles, including Louis XVI, and the various Georgian styles.

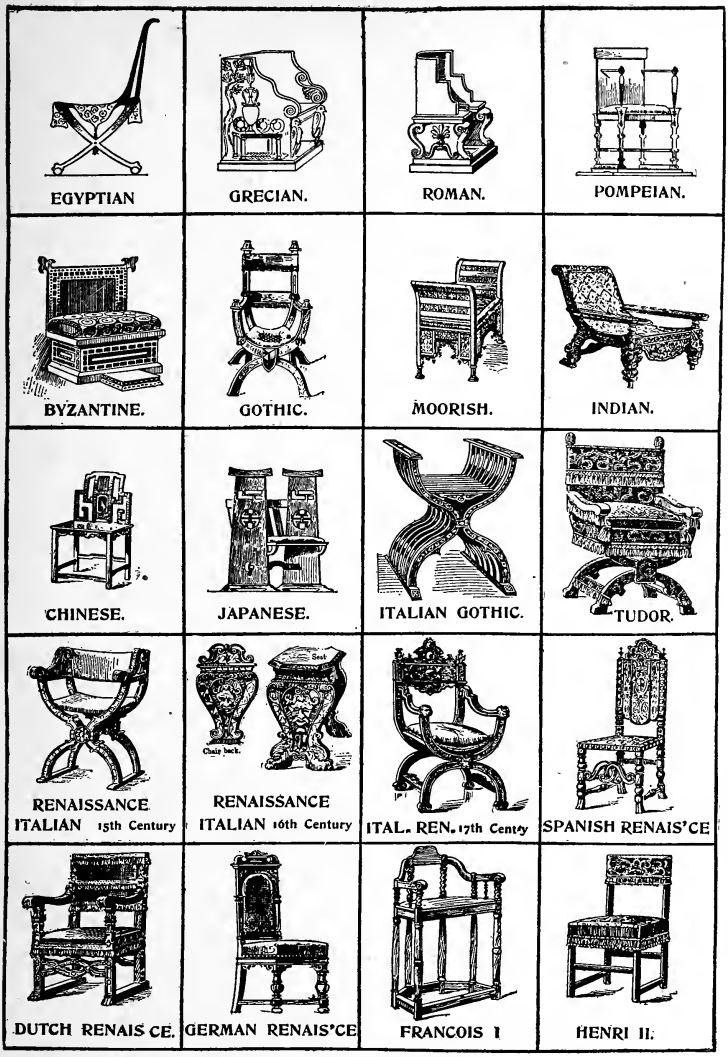
Byzantine.—300 A. D. to 1450 A. D. The "Eastern Roman" style, originating in the removal of the capital of the Roman Empire to Constantinople (then called Byzantium). It is a combination of Persian and Roman. It influenced the various Moorish, Saracenic and other Mohammedan styles.

Gothic.—1100 to 1550. It had nothing to do with the Goths, but was a local European outgrowth of the Romanesque. It spread all over Europe, and reached its climax of development about 1550. It was on the Gothic construction that the Northern European and English Renaissance styles were grafted to form such styles as the Elizabethan, etc.

Moorish.—700 to 1600. The various Mohammedan styles can all be traced to the ancient Persian through the Byzantine. The Moorish or Moresque was the form taken by the Mohammedans in Spain.

Indian.—2000 B. C. to 1906 A. D. The East Indian style is almost composite, as expected of one with a growth of nearly 4,000 years. It has been influenced repeatedly by outside forces and various religious invasions, and has, in turn, influenced other far Eastern styles.

Chinese.—3500 B. C. to 1906 A. D. Another of the ancient styles. It had a continuous growth up to 230 B. C., since when it has not changed much. It has influenced Western styles, as in the Chippendale, Queen Anne, etc.

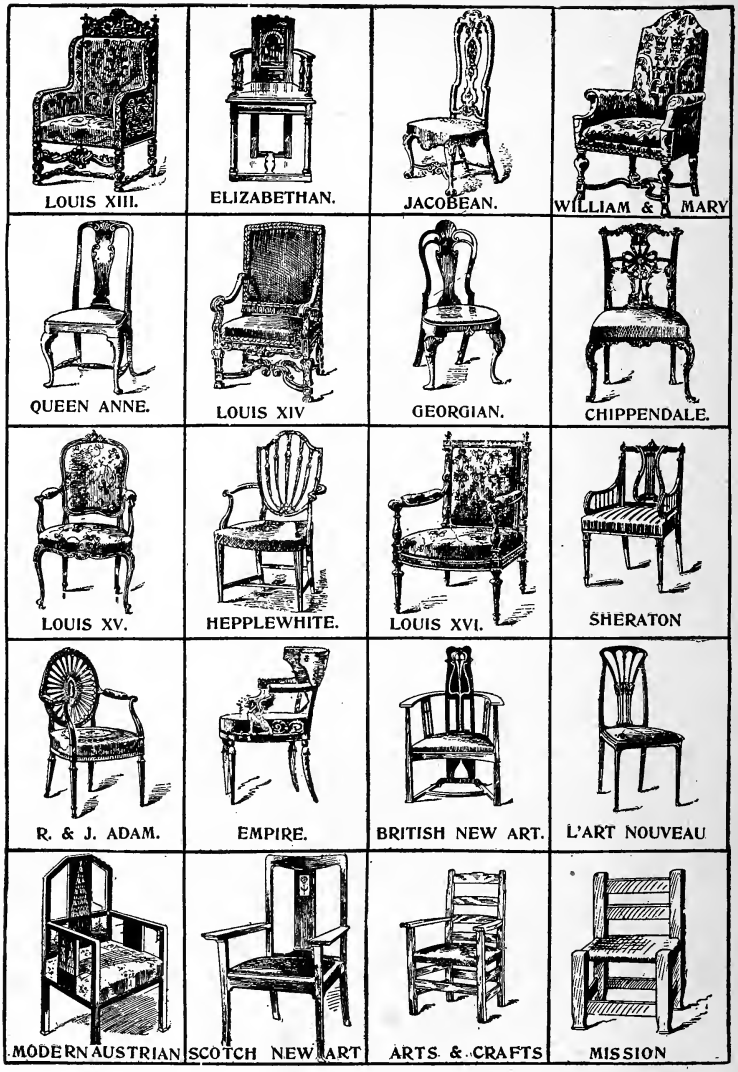


Japanese.—1200 B. C. to 1906 A. D. A style probably springing originally from China, but now absolutely distinct. It has influenced recent art in Europe and America, especially the "New Art" styles.

Italian Gothic.—1100 to 1500. The Italian Gothic differs from the European and English Gothic in clinging more closely to the Romanesque-Byzantine originals.

Tudor.—1485 to 1558. The earliest entry of the Renaissance into England. An application of Renaissance to the Gothic foundations. Its growth was into the Elizabethan.

Italian Renaissance, Fifteenth Century—1400 to 1500. The birth century of the Renaissance. A seeking for revival of the old Roman and Greek decorative and constructive forms.



Italian Renaissance, Sixteenth Century—1500 to 1600. A period of greater elaboration of detail and more freedom from actual Greek and Roman models.

Italian Renaissance, Seventeenth Century—1600 to 1700. The period of great elaboration and beginning of reckless ornamentation.

Spanish Renaissance.—1500 to 1700. A variation of the Renaissance spirit caused by the combination of three distinct styles—the Renaissance as known in Italy, the Gothic and the Moorish. In furniture the Spanish Renaissance is almost identical with the Flemish, which it influenced.

Dutch Renaissance.—1500 to 1700. A style influenced alternately by the French and the

Spanish. This style and the Flemish had a strong influence on the English William and Mary and Queen Anne styles, and especially on the Jacobean.

German Renaissance.—1550 to 1700. A style introduced by Germans who had gone to Italy to study. It was a heavy treatment of the Renaissance spirit, and merged into the German Baroque about 1700.

Francis I.—1515 to 1549. The introductory period when the Italian Renaissance found foothold in France. It is almost purely Italian, and was the forerunner of the Henri II.

Henri II.—1549 to 1610. In this the French Renaissance became differentiated from the Italian, assuming traits that were specifically French and that were emphasized in the next period.

Louis XIII.—1616 to 1643. A typically French style, in which but few traces of its derivation from the Italian remained. It was followed by the Louis XIV.

Elizabethan.—1558 to 1603. A compound style containing traces of the Gothic, much of the Tudor, some Dutch, Flemish and a little Italian. Especially noted for its fine wood carving.

Jacobean.—1603 to 1689. The English period immediately following the Elizabethan, and in most respects quite similar. The Dutch influence was, however, more prominent. The Cromwellian, which is included in this period, was identical with it.

William and Mary.—1689 to 1702. More Dutch influences. All furniture lighter and better suited to domestic purposes.

Queen Anne.—1702 to 1714. Increasing Dutch influence. Jacobean influence finally discarded. Chinese influence largely present.

Louis XIV.—1643 to 1715. The greatest French style. An entirely French creation, marked by elegance and dignity. Toward the end of the period it softened into the early Rococo.

Georgian.—1714 to 1820. A direct outgrowth of the Queen Anne, tempered by the prevailing French styles. It includes Chippendale, Hepplewhite and Sheraton, but these three great cabinetmakers were sufficiently distinct from the average Georgian to be worthy separate classification.

Chippendale.—1754 to 1800. The greatest English cabinet style. Based on the Queen Anne, but drawing largely from the Rococo, Chinese and Gothic, he produced three distinct types, viz.: French Chippendale, Chinese Chippendale and Gothic Chippendale. The last is a negligible quantity.

Louis XV.—1715 to 1774. The Rococo period. The result of the efforts of French designers to enliven the Louis XIV, and to evolve a new style out of one that had reached its logical climax.

Hepplewhite. — 1775 to 1800. Succeeded Chippendale as the popular English cabinetmaker. By many he is considered his superior. His work is notable for a charming delicacy of line and design.

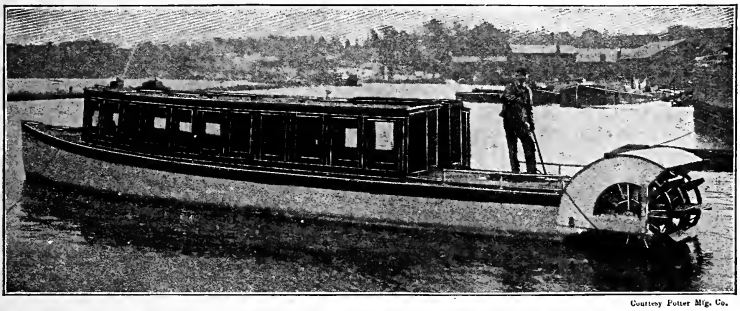
Louis XVI.—1774 to 1793. The French style based on a revival of Greek forms, and influenced by the discovery of the ruins of Pompeii.

Sheraton.—1775 to 1800. A fellow cabinetmaker, working at same time as Hepplewhite. One of the Colonial styles (Georgian).

R. & J. Adam.—1762 to 1800. Fathers of an English classic revival. Much like the French Louis XVI and Empire styles in many respects.

Empire.—1804 to 1814. The style created during the Empire of Napoleon I. Derived from classic Roman suggestions, with some Greek and Egyptian influences.

New Arts.—1900 to date. These are various worthy attempts by the designers of various nations to create a new style. Some of the results are good, and they are apt to be like the "little girl who had a little curl that hung in the middle of her forehead," in that "when they are good they are very, very good, but when they are bad they are horrid."



Courtesy Potter Mfg. Co.

STERN WHEEL CRUISER

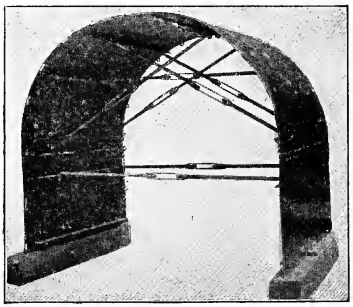
With a draft of only 10 in. the 48-ft. cruiser illustrated affords cruising facilities unusual in shallow-water boats. The beam is 10 ft. and the head room in the cabins is 6 ft. 3 in. The main cabin finished in California redwood divides into two commodious sleeping rooms by means of curtains. The berths are made up from the seats. A fresh water tank containing 80 gal.

is carried forward with a large ice box.

The motors are double cylinder 5 in. by 5 in., driving two paddle wheels of 5 ft. diameter; paddle wheels are independent of each other and reverse. The boat will ride a fairly heavy sea, but was built for cruising in rivers and into lakes where weeds would render a propeller inoperative.

STEEL FORM FOR CONDUITS

A recent invention calculated to expedite the construction of concrete conduits is called the collapsible steel centering. It consists of plates of sheet steel bent to form the exact size of the conduit or sewer which is to be built. Steel rods brace the form while the concrete is poured and setting; then



Section of Form

the turnbuckles are unscrewed and the form taken down and moved away. Fifty lineal feet are sufficient to keep the work going.

SEA SALT STOPS STREET DUST

Salt extracted from sea water has been recommended by a Bordeaux chemist for laying road dust. The sea water is placed in great shallow troughs and evaporated by the sun's action. The different salts crystallize in order of insolubility, chloride of sodium being the first to separate, while the others, more soluble, accumulate in the remaining water.

A few quarts of this "mother sea water" are used to a ton of ordinary water for sprinkling roads. The sea salt absorbs the moisture from the atmosphere, thus dampening the dust. The method would be inexpensive and practicable for places not far from the sea.

OUR 20,000-TON BATTLESHIP

Ten designs were submitted by builders and one was prepared by the Bureau of Construction for the proposed 20,000-ton battleship; Secretary Bonaparte has recommended to congress the department's own plan. Comparison naturally will be made with the "Dreadnaught," which shows our new battleship to be 10 ft. longer—510 ft.—3 ft. more beam and 2,000 tons greater displacement; coal capacity is 400 tons less, equipment of 12-in. guns is the same, but the armor belt extends farther forward and aft.

NEW RAILWAY EQUIPMENT IN 1906

New railway equipment ordered during 1906 was a little less than the previous year but makes a good showing. The Railway Age compiles the following figures:

Locomotives	5,642
Passenger cars	3,402
Freight cars	310,805
Miles track built	6,067

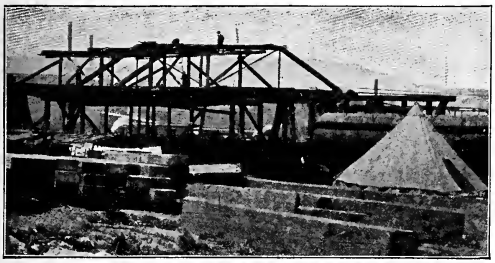
Texas built the most track, 701 miles, and Massachusetts the least, 4½ miles.

LAUNCH EARNS $600,000 A YEAR

The most profitable boat in the world, if not the best paying commercial craft ever built, is the $15,000 launch belonging to the water department of New York city. It is constantly in operation night and day along the water front and collects tolls from vesselmen who help themselves to city water from street hydrants. The boat collects $600,000 a year.

A PERISCOPE FOR THEATERS

The women still persist in wearing high hats in the Paris theaters and in self-defense the men are using an invention like the periscope of a submarine. The device which is called



Where the Line Crosses Another Road's Shops

"The Giant's Eye" resembles an ordinary cane, but is really a tube in which are lenses and mirrors. When raised the lens at the upper end is pointed at the stage while the man looks into another lens at the lower end of the tube.

NOVEL TYPE OF MOTOR BOAT

The motor boat "Sho-Me" illustrated herewith is more unusual than beautiful, and while built for fast moving would be a doubtful proposition in heavy weather. The Motor Boat says it is owned in Daytona, Fla., and made a record of 3:52 over a measured mile course.

RAILWAY OVERHANGS PACIFIC

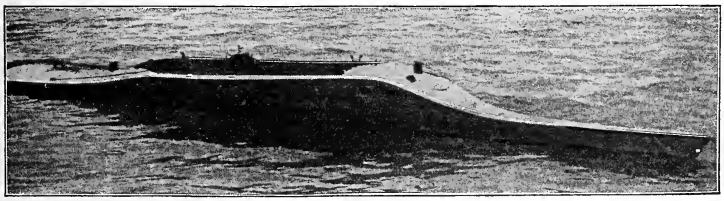
Between San Francisco and Santa Cruz, along the shore and overlooking the mighty Pacific, a remarkable piece of railroad construction is being carried on. The distance is only 85 miles, but San Pedro mountain, rugged and precipitous, has stood a formidable obstacle in the way of other projected shore lines.

At this point, preparatory to active construction, surveyors were lowered over the edge of the cliffs, hundreds of feet above the breakers of the angry Pacific, to lay the grade line. Then followed workmen, clinging to the cliff while like giant woodpeckers they drilled small holes and charged them with dynamite.

At last a broad shelf was blasted out along which is being laid the track of the Ocean Shore Railway. The work in this region alone cost nearly $1,000,000.

Other railroads fought against the new line in every possible way and made it very difficult to get into San Francisco. A long high trestle carries the line over the shops of another company into the heart of the city.

Astronomers are trying to photograph the sun's corona without an eclipse, from the Janssen Observatory on the summit of Mont Blanc.



The "Sho-Me," Built for Speed

THE FOUNDING OF BELLS

Requisite Qualities of the Metal--Methods of Casting--Testing and Tuning

In the sound-bow of a bell—that part of the circumference struck by the clapper—is found the most cosmopolitan of all expressions. The bell speaks the same language of joy, sorrow, or alarm to all nations. And the romance that has emanated from bells since our earliest records of their use in Egypt and Assyria extends even into their manufacture. The use to which the bell will be put determines the compound of metals its maker will select.

The bell-metal commonly used is an alloy composed of 80 parts copper and 20 parts tin, but every bell founder has his own variation of this formula, and in the product experience counts for a great deal. The metal is of a yellowish-gray color, hard, brittle and sonorous; a fracture in it shows a fine grain. The copper used, where quality of tone is desired, must be commercially pure, as the presence of lead, even in minute quantities, affects the tone. The larger the proportion of copper in the alloy the graver and deeper the tone of the bell; while by adding tin, zinc or iron a sharper tone results. Silver gives sweetness to the tone and many very old church bells contain a large amount of that metal. In some cases church bells have been cast from jewelry, coins and ornaments contributed by worshipers.

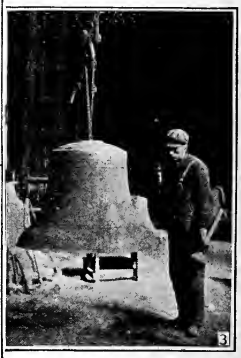


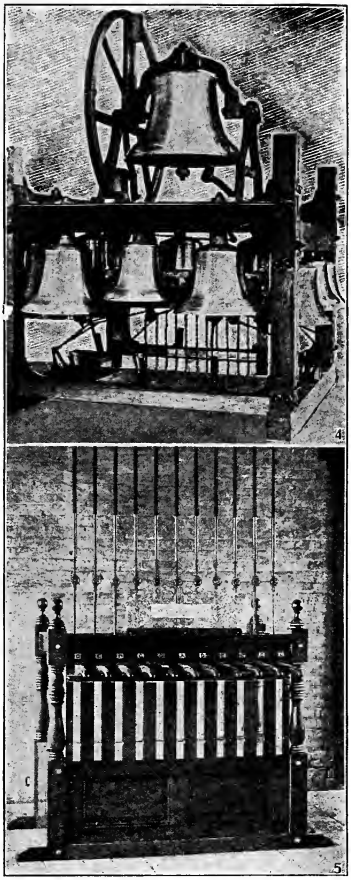
Fig. 1--Moulds. Fig. 2--Pouring the Casting.
Fig. 3--Testing a Chime Bell

In the bell foundry the proportionate requirements for a bell are worked out mathematically, a suitable pattern board procured and a draft made which shows the inside diameter of the bell at the shoulder just half the

mouth diameter; the thickness of the bell through the sound-bow, one-fourteenth of the mouth diameter; the waist thickness, half the sound-bow; the shoulder thickness, a third of the sound-bow; and the heighth of the bell, about 11 times the thickness of the sound-bow.

According to this lay-out, two sweep-boards are fashioned, one called the "core" sweep and the other the "case," or outer sweep. Two iron flasks are provided, also, called the "case" and the "core." The case is an inch or two larger than the required finished mould and in it the outer shape is moulded. The core is an inch or two smaller than the required finished mould and on this the inner shape is moulded. These moulds are shown in Fig. 1, the cope or case with its wide part up and the core with its wide part down. The moulds are each swept up with a rough loam coating on the casting surface and the outer mould receives an impression of the inscription which is to appear on the bell in raised letters, after which it is slicked over.

The moulds are next closed and set around in order under a large crane ready for casting, and here there is a marked difference between our method and the European. It will be noticed that these iron flasks have numerous holes which are provided for a two-fold purpose—to make the loam coating adhere better and to allow the gas which is generated during the few seconds required for the pouring to escape through these "vent" holes and burn itself out. The European method is to sweep up the moulds over brick cores in a pit, and then over this to sweep a bell of clay, and over this—beginning with the smooth coat—they lay on the outer loam form. When the moulds are done, they lift off the outer mould, break up the clay bell, replace the outer mould and then pack the whole in the pit by pressing down the dirt previously excavated and then weighting it down. Nothing shows above the foundry floor level but the "heads" or "gates," into which the molten metal is poured. There is always danger of gas explosion by the European method. By our method this danger is reduced to practically nothing because all our casting is done above ground and in a way that allows the gas to burn out.



Chimes and Keyboard for Playing Them

Figure 2 shows how the metal is poured into the casting when prepared and also shows moulds ready for casting set under the big crane previously

mentioned. The casting is usually done as early during the day as possible, so as to give plenty of time for the metal to slowly cool down by the next day, when the bells are removed from the moulds to finish cooling.

When the bells are intended for a peal or chime, they are lifted up and tested, as shown in Fig. 3, to ascertain their accuracy of pitch and if they are a little off, mechanical tuning brings them to standard. Bells for tower clocks or for fire alarm use or for a church or a school tower, used singly, are not tuned, as individuality of tone in such bells is desirable.

Figure 4 shows how a chime of bells is set up and Fig. 5 shows the lever keyboard with which the chime is played.

WOMAN CARPENTER WHO BUILT HER OWN HOUSE

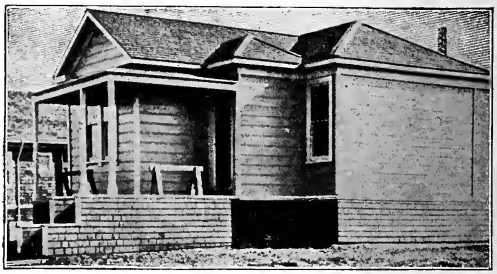
A woman who is an expert carpenter, as well as a brick mason and a painter, is not often found among the fair daughters of Mother Eve. California, however, possesses such a woman, and she lives in Emeryville, one of the suburbs of the city of Oakland — just across the bay from San Francisco.

This woman is a widow, 35 years of age, and her name is Mrs. Bertha Bissell. She has, within the past few months, built, with her own hands, a very neat little one-story cottage containing five rooms and a porch. This building is what is known as a "box cottage"—25 by 15 ft.—containing a parlor, bed-room, dining-room and kitchen. At the front end is a narrow porch.

All this work was done by Mrs. Bissell without the least assistance from any one. She drew the plans herself, and built accordingly. About 18 years ago Mrs. Bissell assisted her husband, who was a skilled carpenter.

"All the plans I drew, and every piece of lumber in the building was measured, cut and put in place by my own hands," said Mrs. Bissell, "and so I know it was done right. There stands the cottage to speak for itself."

She added: "I wouldn't have any carpenters or men to help in this work, as I knew I was well capable of doing all the work myself. No, I had no assistance whatever. I laid the foundation, built the frame, put on the roof, painted inside and out, put in the windows and hung the doors. I think that's not so very bad—for just a woman."

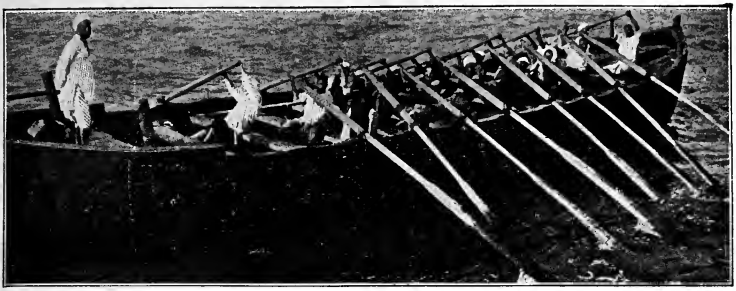


House Built by a Woman

SIGNALING DEPTH OF HARBOR WATER

A Scotch port has an ingenious station for signaling to in-coming and out-going vessels the depth of water in the fairway. A mast on top of a small rectangular building has a vertical cable on either side, one carrying four large balls at specific distances, the other three. Each ball represents a foot of water and it is raised and lowered on the cable by a float in the harbor connected to gearing in the signal house. At high tide all seven balls are visible, but as the tide falls, one by one the balls disappear.

At night a system of powerful lights in the face of the building is used. These lights are automatically turned on and off at the correct time.



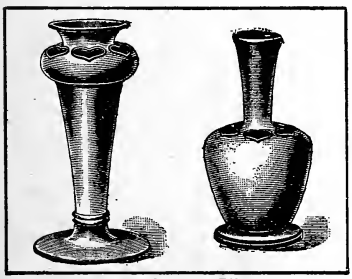
MOROCCO MOTOR SURF BOAT--A Sort of Modern Roman Galley Ship--The Men Stand Up to Pull and Fall Back upon the Seat at the End of the Stroke

CUTTING CHRISTMAS TREES NOT WASTEFUL TO FORESTRY

Most of the evergreens cut for Christmas trees would probably never make good timber and the species usually cut for that purpose have little other economic value. Many are open grown branchy trees that may actually have been a nuisance and it is the general opinion of foresters that there are few uses to which these small fir trees could be put which would contribute so much to the happiness and good of mankind as their use for children on Christmas day.

VASES WITH SIDE OPENINGS

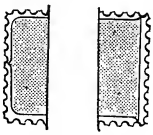
Among the new novelties shown by London jewelers are silver vases for flowers, with openings on the side as shown in the illustration. This arrangement admits of a pyramid effect in one or more colors, according to the blossoms selected for the display.



Gives a Pyramid Effect

HOW TO ENCLOSE A STAMP

On page 1066 of the October number I read "How to enclose a stamp," but think the following a better method. With a pair of scissors or knife, which should be found on every desk, cut two slits on margin of paper as per illustration and tuck stamp in. This avoids moisture or mutilation of stamp.—Contributed by Mrs. H. J. Morton, 40 Campbell Park, Chicago.



PLAN TO EXTEND CHICAGO DRAINAGE CANAL

It is planned to extend the Chicago drainage canal through Joliet and two miles below to Braden's road and there establish a $1,000,000 power plant capable of developing 40,000 hp. It is estimated that the revenue from this plant would approximate $500,000. Joliet would have an inland harbor averaging 200 ft. in width and 24 ft. deep. The extension of the canal, aside from the power plant, would cost $1,000,000.

HOW GLASS BOTTLES ARE MADE

By E. E. Andrews

The manufacture of glass bottles, such as we see everywhere nowadays, is a very interesting process. There is a certain large firm near Chicago which turns out over a quarter of a million of these bottles every day and furnishes employment for hundreds of people. In this factory the glass is melted and the bottles blown around two furnaces. The larger of these is a continuous or tank furnace, constructed as shown in Fig. 1, which is a longitudinal cross section of the furnace. Its dimensions are 75 ft. long by 16 ft. wide and the furnace, but must be recharged with fresh material each time after one charge has been used. It takes about three days to melt a charge in one of these pots, so, in order to avoid loss of time, two sets of pots are used, one set being filled with melting glass materials while the other contains molten glass which is being used.

The materials used in these furnaces are a very pure white silica sand, quicklime, soda ash and saltpeter. When heated together the soda ash, quicklime and silica flux together to form a transparent glass which has a deep green color owing to the presence of a small amount of iron in the sand. The addition of the saltpeter, however, oxidizes the iron so that the color

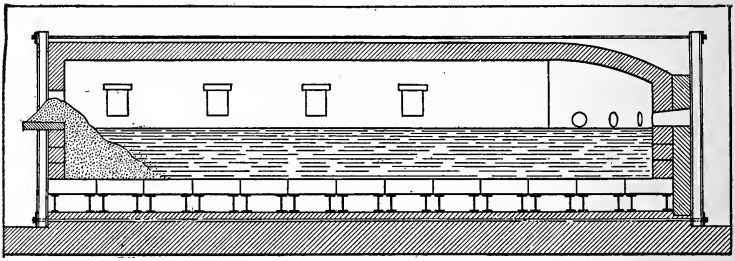


Fig. 1—Continuous Glass Furnace

molten glass lays over the entire length to a depth of 5 ft.

The glass materials are charged in at the rear door and are quickly melted by the intense heat of a blast of burning gas which is forced in through the openings in the side. After the glass is melted the flame plays over it and renders it very hot, thus burning out the impurities and refining the glass. As it passes down the tank the molten glass cools somewhat and is withdrawn at a bright yellow heat through the openings at the lower end.

The other furnace consists of a number of queerly shaped pots (Fig. 2) arranged in a circular brick tower with their necks sticking out through the wall. A gas flame is used to heat these pots, also, which do not yield a continuous supply of glass as does the tank becomes a very light green, and this slight tinge is neutralized by a little manganese dioxide which, alone, would give a pink color to the glass. The molten glass corrodes the fireclay pots and furnace lining very rapidly, so that the furnace must be relined every year, while the life of a pot is only three to four months.

The method of treating the glass after melting is the same in both furnaces. The bottles are blown into cast iron dies (see Fig. 3) and in order to make a complete bottle a number of men are required, each doing a special part of the work. A glass blower stands in front of each opening, equipped with a small iron tube about 3 ft. long and $\frac{1}{2}$ in. in diameter. He dips his tube in the glass, collects a small ball of it, pulls it out and blows it a little, mean-

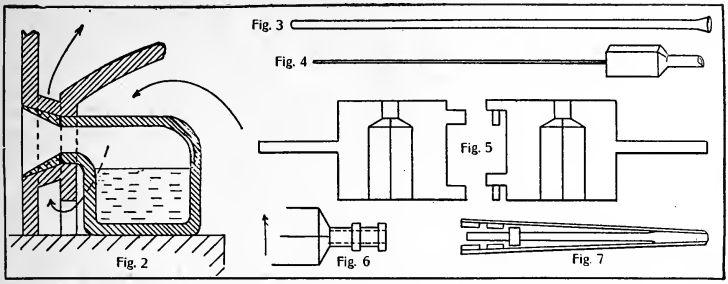


Fig. 2--Single Pot in Pot Furnace. Fig. 3--Blower's Pipe. Fig. 4--Holder for Hot Bottles. Fig. 5--Die. Fig. 6--Neck of Bottle. Fig. 7--Tongs for Shaping Neck.

while rolling it back and forth on a smooth iron plate until it becomes cylindrical in shape; then he puts the still hot glass cylinder in a die, which is opened to receive it and is closed on the glass. This die somewhat resembles a common waffle iron and when the blower applies a little air pressure the plastic glass expands inside it to form a bottle perfect in every part save the neck.

A man operating the dies now removes the bottle ready for another blow and a boy slips the hot bottle into a metal pocket at the end of an iron rod and places it in a small reheating furnace where the neck is heated to redness by an oil flame. A third man then seizes the rod and grasps the hot neck in a specially shaped pair of wooden tongs. These tongs have a tongue just fitting into the neck of the bottle and two jaws with notches corresponding to ridges desired on the exterior of the neck so that when the bottle is rotated in these tongs the neck is given any desired shape.

The glass after this treatment is extremely brittle and the bottles would be very easily broken. To overcome this defect they are placed in large pans and after being heated nearly to dull red are allowed to cool very slowly while passing through a long brick flue. After this thorough annealing, the cool bottles are packed and shipped.

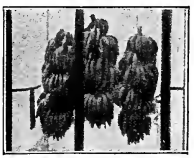
Hammering or vibrating a steel magnet diminishes its magnetism.

DEEPENING THE RHINE

The river Rhine between Mannheim and Strassburg, Germany, is to be deepened so as to be navigable all the year round. In its present state for a period of from 100 to 200 days vessels are unable to pass up the river to the extensive stone docks at Kehl and Strassburg on account of low water. In 1904 the river was only navigable during 150 days. Traffic up the river has increased from 11,513 tons in 1892 to 807,194 tons in 1905. Cost of transportation from all ocean points into southwest Germany and Switzerland is reduced by bringing freight up the Rhine to Strassburg. The cost of the improvement will be $3,212,000.

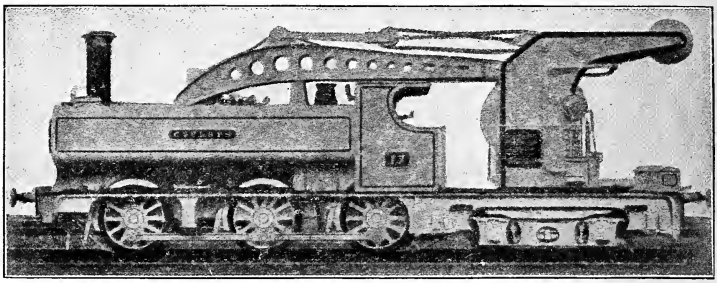
RIPENING BANANAS BY ELECTRICITY

An English electrical expert has discovered a means of ripening bananas to order. The bunches are hung in an airtight glass case in which are a number of electric lights. The artificial light and heat hasten the ripening process in proportion to the number of lights turned on. Records have been made which enable the operators to make delivery of any desired quantities at any agreed date.



LOCOMOTIVE CRANE

A novel piece of wrecking machinery has been built by the Great Western Ry. of England. It combines a locomotive and crane in one, the engine



English Locomotive Crane

weighing 88,000 lb. and the crane 55,000. The length over all is 39 ft., and the lifting capacity 9 tons over a 12-ft. radius.

TIN ROOF RESISTS FIRE

The enduring qualities of a good tin roof when subjected to intense fire are described in the Metal Worker by a Baltimore correspondent, in an article on the behavior of various types of roofing during the big conflagration in 1904. He says:

The New Assembly Rooms, so-called, were covered many years ago, probably 50 years, with tin. The building caught fire about 6 p. m. and burned under and along the edges of the sheathing for hours, being extinguished and starting in new places. I watched it for two hours, and the building did not succumb until 3 o'clock the next morning, nine hours afterward, and then the tin roof lay all over the ruins, having fallen with the walls. It lay there for days, until the rebuilding began. Good tin for roofing is the lightest, easiest repaired and the neatest roofing material that can be used; it is lightning and storm-proof and a fire retardant and fire confiner.

LIFE-SAVING VEST

An English inventor walked to the bank of a deep lake in a public park in London and threw himself into the water. Before the life saver stationed on the ground could reach him the man had lit a cigar and was calmly reading a paper. It was his novel way of demonstrating the life-saving qualities of his "balloon vest," the lining of which contains a rubber bag passing around the body. This bag can be inflated by means of a rubber tube and mouthpiece, a check valve prevent-

The Balloon Vest

ing the escape of the air. The buoyant power of the bag of air is sufficient to keep the arms and head above water.

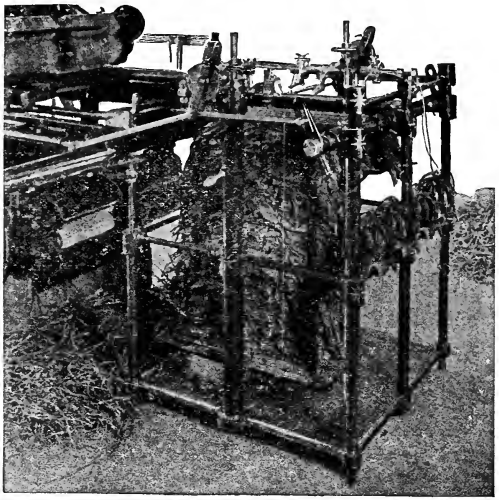
A residence on the Hudson river has a noise-proof chamber 22 ft. square blasted out of the rock beneath its foundations. The room is fitted up for chess playing and was necessitated by the whistling of the river craft.

TOBACCO STEMMING MACHINE

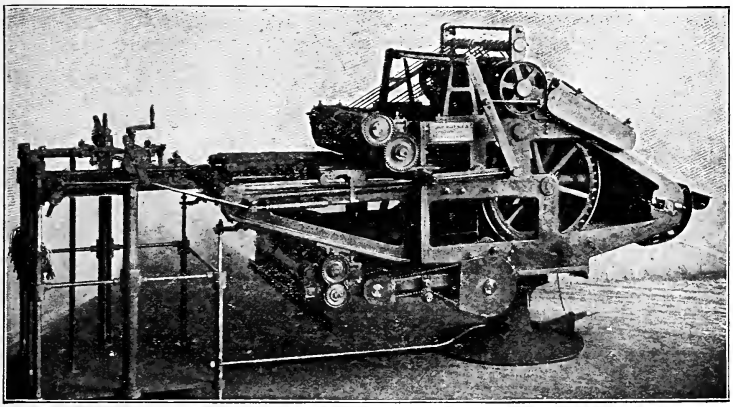
There are 400,000,000 lb. of tobacco stemmed each year in this country alone; and practically all of it stemmed by hand, requiring the services of 200,000 employes.

For over 40 years past inventors have been spending their time and fortunes in what seemed the hopeless attempt to design a machine which would do this work. One Chicago inventor has worked steadily for 14 years and has just won hard earned, but gratifying, success in the machine illustrated.

The leaves to be stemmed are fed into the machine, one at a time, by unskilled labor and—the machine does the rest, removing the stem, cleaning the leaves, counting each one, throwing out the stem in one pile, and laying the leaf in another which when big enough constitutes a bale. From 70 to 140 stripped leaves constitute a pound. One experienced feeder or two green men will feed the two sides of the machine and run through 1,200 leaves per hour. The machine removes from tobacco manufacturing one of the hardest and most unpleasant features of the work and at the same time effects a saving of 300 per cent in the cost of the work.



Discards Stems; Piles up Leaves



FIGHT FOR LIFE IN SUBMARINE

How the Crew of the French Boat "Lutin" Met Their Fate

It is known that the men of the ill fated submarine "Lutin" fought desperately for their lives before being drowned, says the London Express. It will be remembered that the submarine went out in rough weather, and was followed by the tug "Iskeul." After three dives Capt. Fepoux signaled to the tug that he was about to drop 48 ft. for a fourth dive.

The water ballast was taken on board and the submarine disappeared in the waves. When it had arrived at a depth of 48 ft. (as the manometer showed him), the captain ordered the valve to be shut. The sailor whose duty it was did so, but when the valve was two-thirds shut the sluice stopped, and the sailor, thinking it was closed, left it.

The captain then ordered water to be pumped out, and his orders to that effect are noted on the log. But the valve was open, and the water continued to pour in and the submarine to sink deeper.

Then the turbine was set working, but under the pressure of the water six holes were torn in the sides of the "Lutin," the accumulators were paralyzed, and the wretched sailors worked feverishly in an inky darkness, broken now and again by a flash, as one short circuit after another occurred. In the dark the men felt their way to the compartment forward, for the turbine in the stern would not hold its own against the inrush of water. They reached the forward compartment, closed the partition, and fought feverishly for life.

Then the lead weights of the fore part were set free, and the "Lutin" made a sudden leap above the surface of the water. The sailors on board the "Iskeul" saw her leap out of the water prow upwards, like a dolphin at play, and plunge down again for the last time.

The sailors on board the fated ship tore their shirts and clothes, and in their frantic fight for life tried to stop all openings until the "Iskeul" should bring help.

It was exactly 10:30 when the water stopped the clock in the stern. The clock in the tower stopped at 11:25. For nearly an hour the fourteen sailors must have waited for the help which did not come, and then they made one last desperate bid for safety. They opened the hood (capot), but the water rushed in like a mill sluice, and all was over.

The cause of the disaster is believed to have been a little stone the size of a walnut, which became fixed in the valve and prevented it from closing properly.

DOMESTIC ALCOHOL HEATERS

Now that the denatured alcohol bill has become effective we may expect American manufacturers will not be long in putting on the market many of the household conveniences which

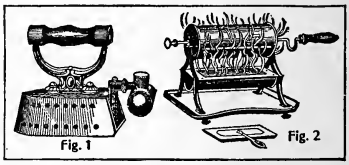


Fig. 1 Fig. 2

have been in general use in Germany for years. There a large assortment of heaters, cookers, lamps and other household articles are considered indispensable. Fig. 1 shows a German flatiron with alcohol burner, and Fig. 2 is an alcohol burner for roasting coffee.

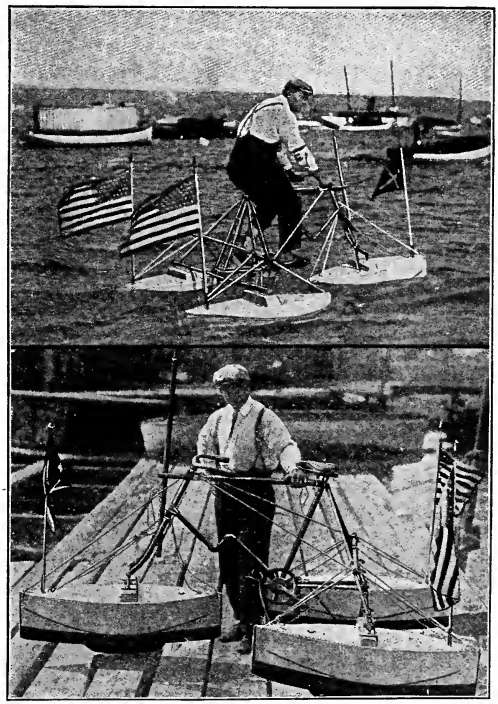
Smoking pipes made from the curved stem of the calabash are said to give a pleasing softness of flavor peculiar to themselves. The cheaper pipes are lined with tin; others with meerschaum, and they sell from 97 cents to $62. Our South African consul recommends calabash growing and pipe manufacture as a profitable industry.

BICYCLE BOATING GREAT SPORT

These Machines Will be Seen in Large Numbers This Year

The bicycle boat which in one form and another has appeared at intervals during the past 10 years, seems likely to become quite popular next season. The ease with which a small gasoline motor can be adapted as the motive power, thus making a water "motorcycle," opens up a new type of outdoor sport which has great possibilities.

A recent bicycle boat built by a stage carpenter in New York is shown, and will prove suggestive to any of our readers who wish to build one for themselves. This machine is 8 ft. long, 5 ft. wide, is reversible, and weighs 60 lb. The propeller is a 10-in. wheel; 3-bladed. Provision is made for a small sail to be carried by a tube attached to the head of the frame. This boat will be equipped with power and exhibited at the sportsmen's show in New York.

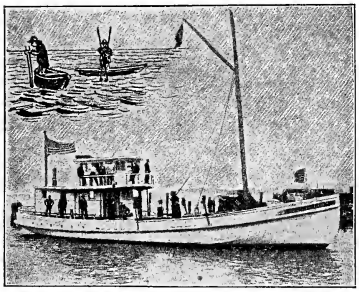


The Bicycle Boat is as Handy and Safe on Water as the Ordinary Bicycle is on Land. A Small Motor can be Easily Attached, Affording a Speed of 10 Miles an Hour.

The pontoons are of galvanized iron which can be made at any tinshop; those in the illustration are each 4 ft. long.

OYSTER FISHING BY MACHINERY

Instead of the tedious operation of manipulating the old-fashioned oyster tongs, which resemble two rakes hinged together, the shell-fish are now

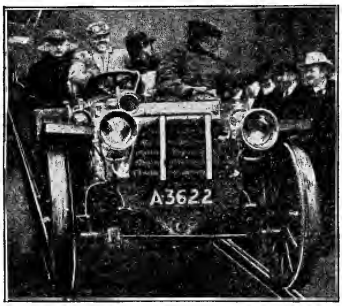


The Old and New Way

brought up at the rate of 3,000 bu. a day by means of dredges. The modern oyster boat shown in the illustration is equipped with four dredges operated by a 100-hp. gasoline engine, which is also used for propelling the boat when not running the dredges. The boat has a carrying capacity of 3,500 bu. of oysters.

RAILROAD AUTOMOBILE TRIP

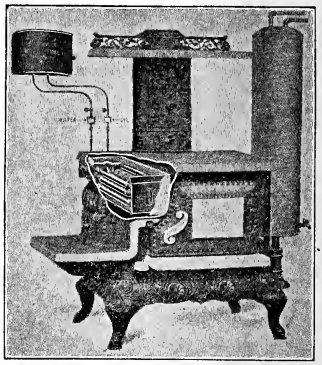
Chas. J. Glidden with his wife and party of friends are making the trip from Chicago to the City of Mexico on railroad tracks, his auto having been equipped with heavy flanged iron wheels. The machine will, of course, furnish its own power, and the car will run as the second section of a through passenger train under orders from the train dispatchers. Two years ago Mr. Glidden made the trip from Chicago to the Pacific coast in the same manner and found no difficulty in keeping up with the passenger train ahead. The steering gear is fastened, as the flanges guide the car.



Auto Leaving Chicago

OIL BURNER FOR RANGES

By means of a new device oil and water can be burned as fuel for cook stoves. The plan includes a tank divided into two compartments; one of which contains the oil, the other water. Small pipes lead to the burn-

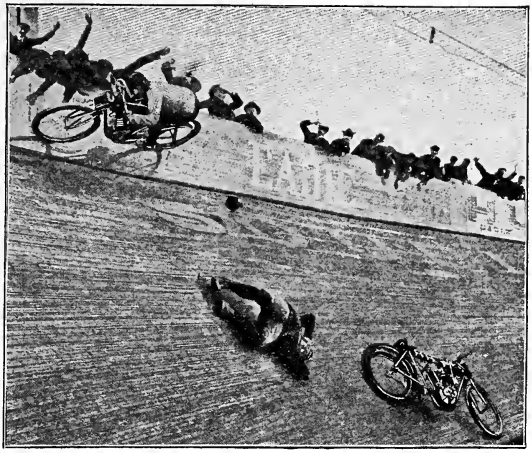


Oil-Water Burner

ers in the stove. The oil pipe is first opened quickly, heating the vaporizer in which the oil and water are converted into gases and mixed. An intense heat is produced which can be regulated as desired. The process is perfectly safe and can easily be applied to any stove.

MOTORCYCLE RIDES A WALL

A most remarkable demonstration was made on a race track in Paris where two motorcycles were running at 50 miles an hour. Owing to an accident to one of the machines its rider was thrown, and to avoid running over him, the other rider turned his machine so suddenly that it left the track and climbed the palisade. After running 100 ft. with the rider and machine in a position almost horizontal, the motorcycle ran off the palisade and literally rode on the breasts of the spectators, two of whom were killed and many seriously injured.



Motorcycle Rides on a Wall

POSTAGE RATE SHOULD BE REDUCED; NOT RAISED

Some personal interest, thought by many to be the express companies who would benefit several million dollars a year by the proposed change, has induced Congress to appoint a "postal commission" which is expected to report at the present session. The Postoffice Department, through Mr. Madden, recommends an increase from the present rate of 1 cent per pound on newspapers and magazines to 4 cents per pound. Not 10 per cent of the publishers could pay the new rate, which means there would be a big advance in all subscription prices,—and the people will have to pay the bill.

By a system of book-keeping which no business concern would tolerate, an apparent "deficit" is made each year, and it is proposed to make the publishers pay this. There is no actual deficit. The free matter carried for other branches of Government amounts each year (according to Postoffice Department's own figures) to more than the "deficit."

The 37,000 rural free delivery routes—which have reduced insanity among farmers 40 per cent in 10 years, and which are rapidly becoming self-sustaining—this rural delivery alone costs this year $26,000,000, and represents a temporary loss of more than the alleged "deficit," but is worth to the nation twice its cost.

Canada carries its newspaper mail at ¼ cent per pound within 300 miles and at ½ cent beyond that, and cleared $490,000 last year.

The proposed raise in the price of the reading matter of the nation is an outrage on the people. It is to be hoped the "consideration of the question" will be forced to the root of the matter, which ought to result in an entire revolution in postal methods and administration.

We are credibly informed that on a passenger train leaving Chicago every night there are two express cars for which the express company pays $200 per trip. On the same train are two mail cars for which the Postal Department pays $700 per trip for the same service and the same distance.

That there is no actual deficit under such conditions shows how profitable are the present rates of postage, and that instead of a raise there should be a decrease, both in the letter postage and newspaper rates.

The people do not ask for the change.

Then who does?

110-Ton Locomotive
"Battleship" Type
for Heavy Through Freight Service

PASSING OF THE WOODEN FREIGHT CAR

And the Wooden Passenger Coach Should Go With It

The statement is made that owing to the scarcity and consequent high price of lumber, the wooden freight car being turned out at contract shops is greatly inferior in quality to those of a few years ago. The wood is full of sap and before the car really gets into service posts and boards show shrinkage. The Railway Age says:

"Even the paint on a modern box car is a fugitive mixture of mineral pigment and gasoline, slushed on with a wide brush and soon to evaporate and leave a dry powder to be washed off by the rain. The soft wood when left unprotected will more rapidly decay unless it receives a better covering at the home shop.

"The manager who considers the purchase of wooden cars, on account of a slender appropriation and the desire to have as large an equipment as possible, must reckon with the disadvantages above mentioned if he builds for the future. The wooden car is constantly growing poorer in quality and the average life will be much less than that indicated by figures obtained from the cars in use prior to the age of steel."

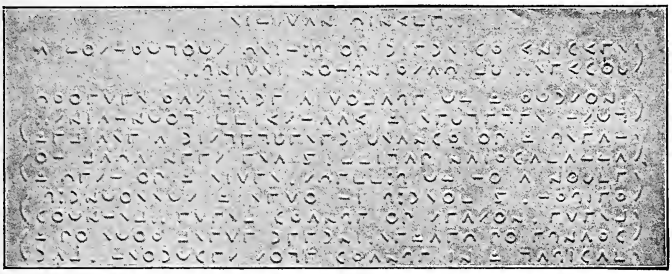
The years of the wooden passenger car are likewise numbered. Hundreds of passenger cars are in service today which in a wreck would crush like eggshells and burn like tinder just as some of them did on November 12 on the Baltimore & Ohio railroad. While the collision was due to inexcusable carelessness, which the use of steel cars would not have prevented, no one will believe that the 100 or more victims who were pinned down by timbers and slowly roasted to death would have lost their lives in a modern steel car. There might have been some broken limbs, but a steel car never cremated anybody. Cities prohibit the use of bad boilers and stop the operation of dangerous passenger elevators, and in other proper ways protect the public, and it is not expecting too much that before a great while the Federal Government will make the penalties for using

rickety old passenger cars so severe that railway officials will not then risk their own liberty, nor the lives of the public as at present.

Certain trains on some of the better roads are now made up of cars in which the coaches are nearly as safe as the heavy sleepers, but on occasion the best of them run out old traps that are ready to fall to pieces, and with some the offense is an hourly one every day in the year.

MAGAZINE FOR THE BLIND

Nearly 1,000 books, with editions which total 256,000 volumes, have been printed in raised letters for the blind by the Moon Society of London, established in 1847. The books include bibles, poetry, biography, history and text books, issued in 400 languages. The Moon Society has branch free circulating libraries in Great Britain and its possessions—which last year loaned 100,000 volumes—and in this country in New York, Boston, Cincinnati, Chicago, Philadelphia, Washington and Sacramento.



Reduced Reproduction of Part of Page of Moon's Magazine. Translation of First Three Lines Reads as Follows:

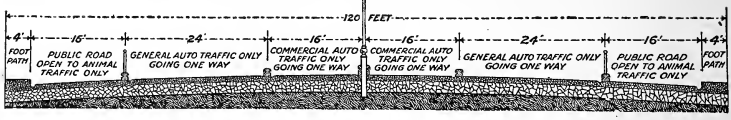
RIP VAN WINKLE . .
A POSTHUMOUS WRITING OF DIEDRICH KNICKER
. . GNIVRI NOTGNIHSAW YB REKCOB

Two years ago the late Dr. Wm. Moon, founder of the society, and himself blind for 70 years, started a monthly magazine for the blind, the pages being 11 in. by 13 in., with a table of contents on the front cover. This magazine is now conducted by his daughter, Miss Moon, and edited by his son, Dr. R. C. Moon of Philadelphia, Pa.

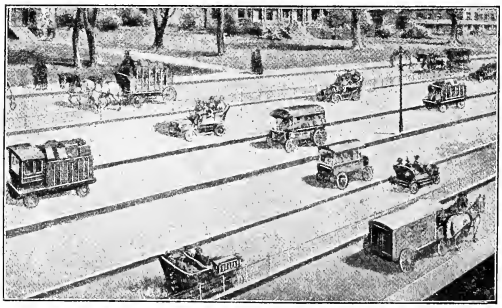
Instead of printing from the type with ink, a special embossing press is employed, a process necessarily somewhat slow and painstaking. The letters are ¼ in. high and raised about 1/16 of an inch, with plenty of space between the lines, which instead of all reading from left to right, weave back and forth. All titles, and the first line of each article, and after that every other line reads from left to right; the other lines from right to left. The large parentheses at the ends of lines guide the finger to the line below.

A similar monthly magazine will shortly be issued in this country, under the direction of Walter G. Holmes, of New York City, necessary funds having been donated by Mrs. Wm. Ziegler. The magazine will be sent free on request to any blind person who can read the raised letters. Those who cannot read will be sent free alphabets and instructions, from which they can quickly learn, if apt.

PROPOSED NEW CITY ROADWAY



Cross Section of Commercial Roadway



There Are Six Distinct Roads

A plan for a commercial highway is proposed along the lines shown in the illustration.

There are six distinct roadways: two for animal traffic, two for general auto traffic, and two for commercial auto-traffic. The three avenues on each side are for travel in one direction only, the other three for use in the opposite direction. Pedestrians use sidewalk on extreme outside.

Electric light poles to be placed in the middle, and each avenue separated from the next by a concrete curb. The extreme width of street is 120 ft. including footpaths. The design is copyrighted by H. D. and F. P. Layman.

LARGE CONSTRUCTIONS COST LIVES

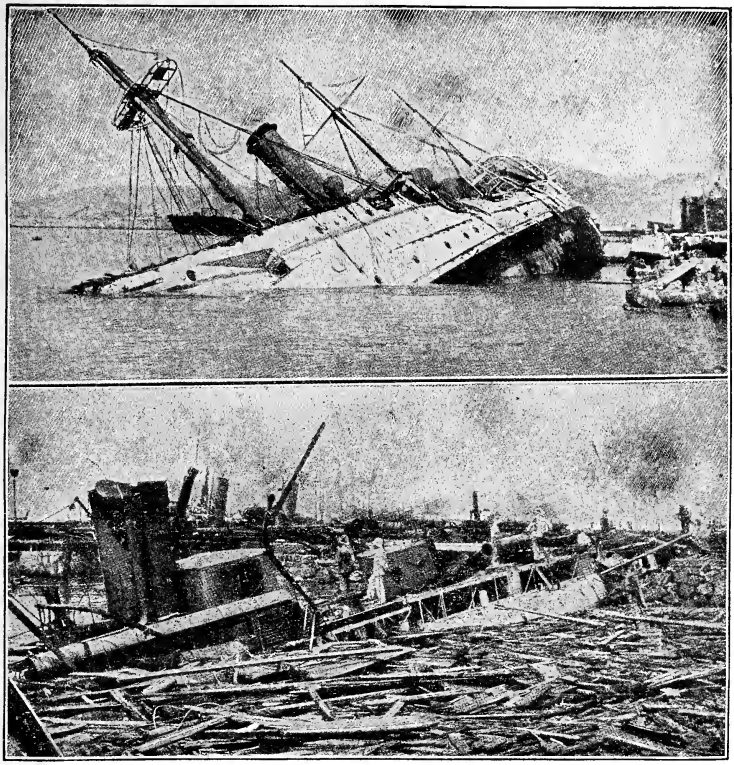
The construction of any large engineering undertaking, such as tall buildings, large dams, railroads, etc., includes as one of the costs a definite loss of human lives. In other words when a big skyscraper is planned the engineers can reckon the number of lives it will probably cost while the building is yet on paper. During the past year in Chicago alone 34 workmen have been killed while engaged in erecting large buildings, and 113 more were seriously injured. Danger lurks all along the line, and the death-causes ranged from a bucket falling on a man at the bottom of a foundation caisson 100 ft. deep, to falls from the top of the same building to the street, a drop of from 200 ft. to 300 ft.

Eiffel, of tower fame, declares the average death loss is one life to each $250,000 of cost of the construction.

SUBMARINE "LUTIN" RAISED

The ill-fated French submarine, "Lutin," which sank in 150 ft. of water, has been raised, and the bodies of the crew of fourteen, recovered. A floating dry dock was lowered below the water line, and the submarine attached by heavy chains. The dock was then raised by emptying her water-tanks, and dock and submarine towed into port.

An English inventor now offers a detachable compartment in which several persons could escape, if the submarine is fortunate enough to land on the bottom in such a position that the compartment can be released.



The great typhoon of September 18, 1906, at Hong Kong was remarkable as the only one on record which came without warning. Thousands of lives were lost, while the money loss ran into millions, says the Illustrated London News. The vessel at the top is the British vessel "Phoenix"; the other wreck shows the remains of the French destroyer "Fronde."

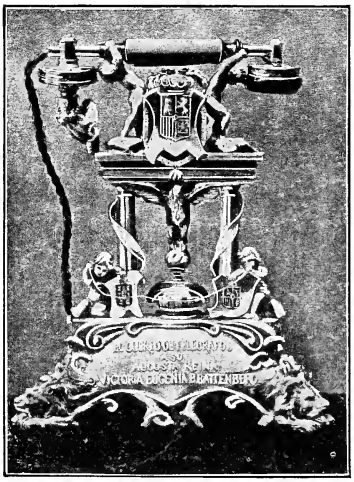
SAWED STEEL BAR WITH YARN

What the drop of water does to the hardest stone is only a circumstance to what a thread of yarn can accomplish. Major McClaughry, warden of the Federal prison at Ft. Leavenworth once found a prisoner who was supposed to be pounding stone, working away at one of the bars to an outside window. The man finally admitted what he was doing and was induced to give a demonstration.

A grating of the same description was placed in his cell and a guard stationed over him to exact the proof of the statement. With the limestone dust and silicate from the stone pile, the yarn from his sock and a little water this man cut the Bessemer steel bar in eighteen working hours. With some fine emery, a chalk line, and two wooden handholds to save his fingers he made the other clean cut of the bar in five hours, proving the matter to the guard's satisfaction.

UTILITY OF THE TELEPHONE

Of all the applications of electricity the telephone is most used by the people. While the telegraph cannot now be spared, the masses use it only in



Jeweled Telephone Used by Queen of Spain

emergencies where the mails are too slow. The telephone is in the home and much of its service is commonplace, though useful. The latest phase is the discussion by the Roman Catholic clergy as to the propriety of employing the telephone for the reception of confessions where conditions prevent the member from coming in person to the priest.

New Fruit Paring Knife

The latest in a fruit knife for table use is a radical change from the time-honored style. The improved form will cut twice as fast and twice as thin as an ordinary knife. It operates on the principle of a safety razor. For use in preparing vegetables and fruit for cooking it is said to be a great saver in both time and material.

Cuts Very Fast

CAPE TO CAIRO TELEGRAPH

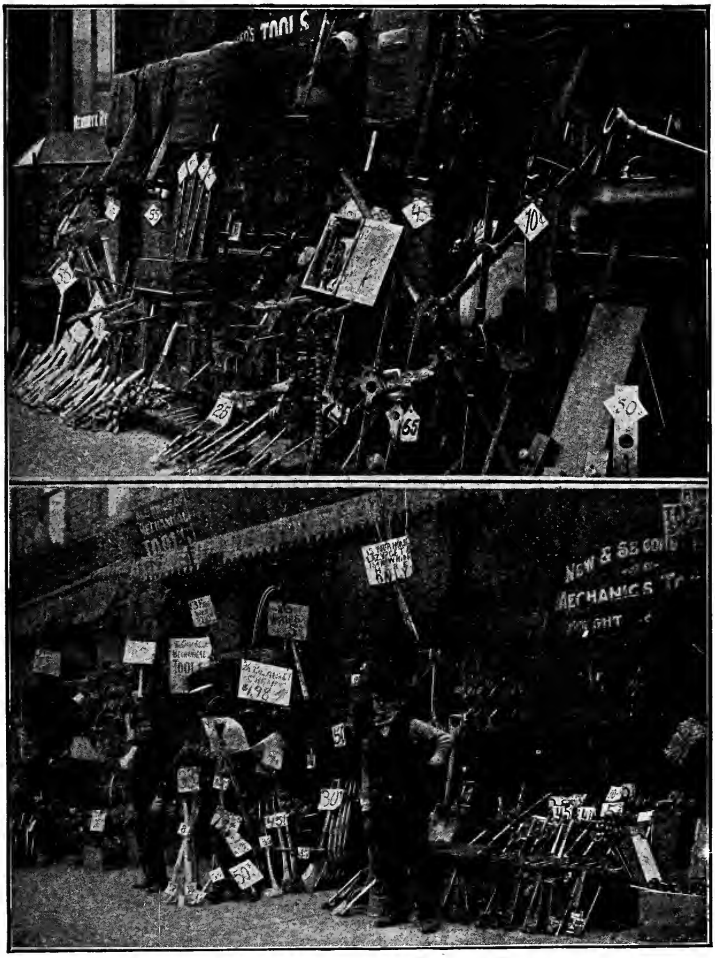
The longest telegraph line in the world, the idea of the late Cecil Rhodes, lacks less than 1,000 miles of completion. The distance is 5,600 miles. Through jungles, across deserts, over vast chasms, in the face of the most difficult obstacles engineers have ever encountered, the work has been carried on for eight years. Part of the gap, about 400 miles, is through jungles where no white man has ever penetrated, and at present is acknowledged as too difficult to cross. The gap will be worked by wireless and

Building the Line

the rate over the entire line will be only 25 cents per word.

For hundreds of miles wooden poles were destroyed by insects and hollow iron poles weighing 160 lb. had to be substituted. Even these are frequently broken by elephants rubbing against them. Among some of the African tribes small pieces of wire pass for money which is another cause of trouble. Wild beasts, savages, serpents and pestilence have joined forces to hold back the enterprise, but each in turn has been overcome.

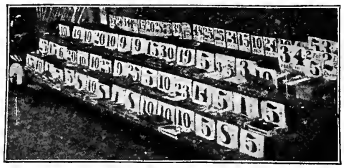
JUNK TOOL STORES



Second-Hand Tool Stores, Chicago

In every large city will be found one or more places where second-hand or junk tools are sold. Tools of all descriptions, adapted to every branch of mechanics, can be bought at prices ranging from 1 cent up; a good sized paint brush brings 2 cents, a carpenter's hammer 5 cents, a pick or shovel 25 cents, a rip saw 10 cents, and so on. The average price is less

than one-tenth what the new article would cost at a hardware store, and often just as useful as a new one. Some of the stuff in the motley collec-



"A Paint Brush, 2 Cents"

tion comes from unredeemed pawns, some from junk dealers and a good deal from parties of whom "no questions are asked." Frequently quite valuable tools and instruments can be had for a mere song, as the most of the customers want the tools of ordinary use requiring less skill to handle.

INVALID'S MOTOR CHAIR

Invalids who are able to go out of doors, and who have the use of their hands, will be interested in the latest novelty, the motor chair.

Comfort and Ease of Operation

It is in reality a motor tricycle and is designed for the use of cripples or invalids who are not incapacitated from taking care of the machine. Power and speed necessarily have been subordinated to the demands of comfort and from the side its appearance differs very slightly from that of the ordinary wheeled chair. Liberal sized pneumatic tires are used on the rear wheels, which are about 28 in. in diameter, but the steering wheel is of such diminutive size that any attempt to speed the machine would result disastrously. This wheel has a small solid rubber tire.

The motive power consists of a 4½-hp. air-cooled gas engine, mounted on the rear axle at an angle tilted backward from the vertical. Instead of driving directly to the axle or driving wheels, however, a variable speed gear, affording a range of 5 to 15 miles an hour, is interposed. A special form of foot brake acting directly on the motor shaft is provided.

It is a French invention not yet on the American market. Some enterprising Yankee would doubtless do well with such a specialty. Just before the St. Louis exposition, a similar chair motor, only operated by storage battery, for carrying two passengers, was proposed and a few were constructed. We published a picture of the chair and several hundred inquiries were received indicating a surprising interest in the device. The company seeking the concession, however, failed to carry out its plans.

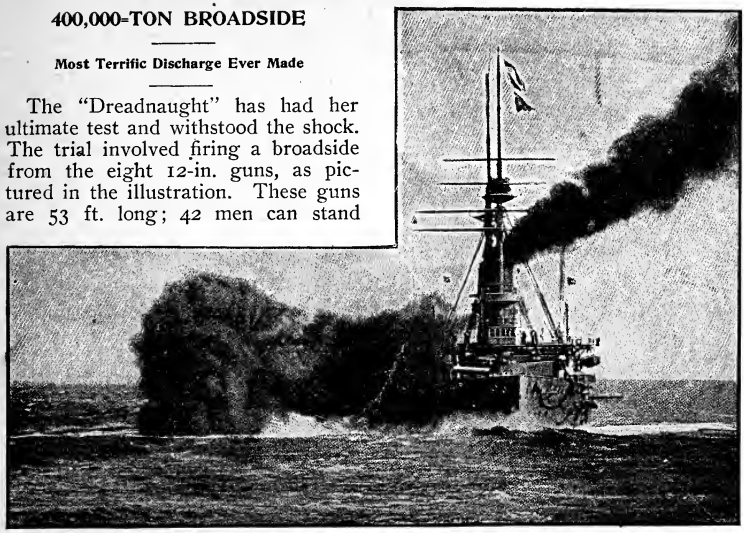
PAPER FROM EGYPTIAN PAPYRUS

A London syndicate will have 100,000 tons of Egyptian papyrus plant ready to ship to its paper mills within the next six months. This revives an industry which has been extinct for over 1,000 years. A long search finally located a few plants in Palestine which were transplanted into Egypt and cultivated. The twentieth century seems to find frequent occasion to learn from the vast treasure house of knowledge of that remarkable people.

400,000-TON BROADSIDE

Most Terrific Discharge Ever Made

The "Dreadnaught" has had her ultimate test and withstood the shock. The trial involved firing a broadside from the eight 12-in. guns, as pictured in the illustration. These guns are 53 ft. long; 42 men can stand shoulder to shoulder on one of them, from breech to muzzle. Each shell weighed 850 lb. and left the gun at a speed of 5 miles a second. Could this rate of travel be maintained the shell would travel from London to New York in 90 minutes, and go around the world in less than 13 hours.



Broadside by English Battleship "Cornwallis"

The energy generated by these guns is estimated to be 50,000 tons for each gun, at the muzzle; or for the broadside of 8 pieces a total of 400,000 tons. The discharge caused the "Dreadnaught" to move sideways a distance greater than her own beam, and to list heavily, while the vacuum produced temporary cyclones around each gun.

A grand boulevard, 10 miles in length, leading from the gates of Paris to St. Germain, is planned to be constructed in Paris at a cost of $2,000,000. There will be an electric railway under the avenue, a drive on one side, a motor car track on the other, two cycling tracks and two footpaths.

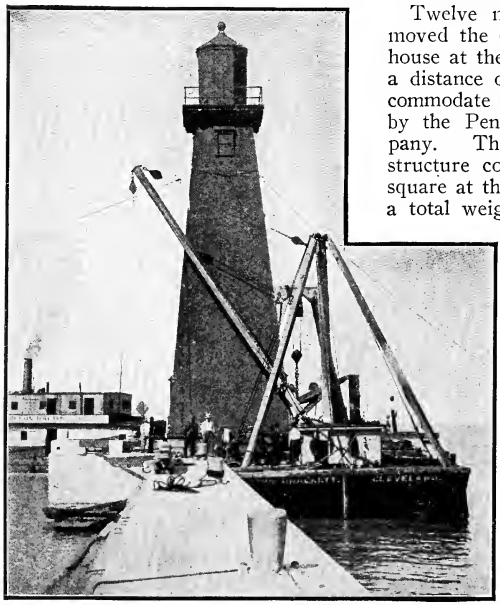
TELEPHONE OVER THE MISSOURI

Owing to the constantly changing bottom of the Missouri river a cable is not considered practical and the telephone wires connecting Council Bluffs and Omaha are suspended from a steel tower on each bank, 110 ft. high. These towers are built of galvanized iron and each will sustain a strain of 20 tons. The guy ropes are carried back 700 ft. and anchored to heavy concrete blocks.

ALCOHOL FIRE RISK SMALL

Very little fire risk is involved in the handling and use of denatured alcohol. The benzine used will be a hydrocarbon obtained either from petroleum or coal tar having a specific gravity of not less than 8.00 and a boiling point of not less than 150° C., and will be no more dangerous in point of fire risk than the alcohol itself.

MOVED TALL LIGHTHOUSE BY BOAT



Lighthouse Partly on Boat

Twelve men in four hours' time moved the 65-ft. 65-ton range lighthouse at the Ashtabula, Ohio, harbor a distance of 750 ft. recently, to accommodate improvements being made by the Pennsylvania Railroad Company. The lighthouse is a frame structure covered with metal, 18 ft. square at the base, 65 ft. high and of a total weight of 65 tons, and prior to moving it was not dismantled at all.

Jacks were placed under the building and, as it was raised, four guy ropes were used to steady it. After being suitably blocked up it was next placed on rollers and by alternately moving the building and loosening and tightening the guy ropes, it was soon deposited on a lighter which lay in the main river right next to the dock on which the range light stood. Whether the towering structure could be held steadily on the moving vessel, or would overbalance and topple into the water, was an anxious question. Once on the lighter, however, it was slowly moved along to the new site on the end of a concrete pier. Then it was again blocked up and moved on rollers to place, uninjured in any respect.

CONDUITS FOR HIGH VOLTAGE TRANSMISSION

One of the problems which is engaging the study of electrical engineers is the solution of a suitable cable and conduit necessary for high voltage transmission. At present practically all the high voltage lines are carried in the air, involving very costly construction, as no chances must be taken on the lines going down in a storm. There are some transmission conduits in cities carrying voltages up to 10,000, it is true, but the 25,000 to 60,000 volt lines are still in the air, with serious losses from leakage. The Electrical Review says "the insulation thought to promise best for such cables is one consisting of cloth tape properly impregnated with some good compound."

UNITED STATES COPPER PRODUCTION

In 1845 all the copper produced in this country aggregated a scant 100 tons; for 1905 we produced over 901,000,000 lb.—one of the greatest industries in the world. Of this production China bought 80,000,000 lb. The Lake Superior mines yielded

25.5 per cent; Montana, 34.9 per cent, and Arizona 26.2 per cent. The Arizona production will surprise many of our readers.

The combined world's production of 1905 was 701,252 tons, of which North America furnished 502,822 tons.

The United States output for 1906 is estimated to show an increase of 70,000,000 lb. over the preceding year.

The first ferry line to cross the open sea will be established on the Baltic betwen Germany and Sweden. The distance of 70 miles will be covered in four hours and the boats will carry an entire train.

THE ROTARY IS KING

This is the season when those railroads which cross the mountains in northern latitudes have their annual battle against snow. The invention of the rotary snow plow has reduced snow blockades from days to hours, and incidentally relieved the workmen of their hardest task of the entire year.

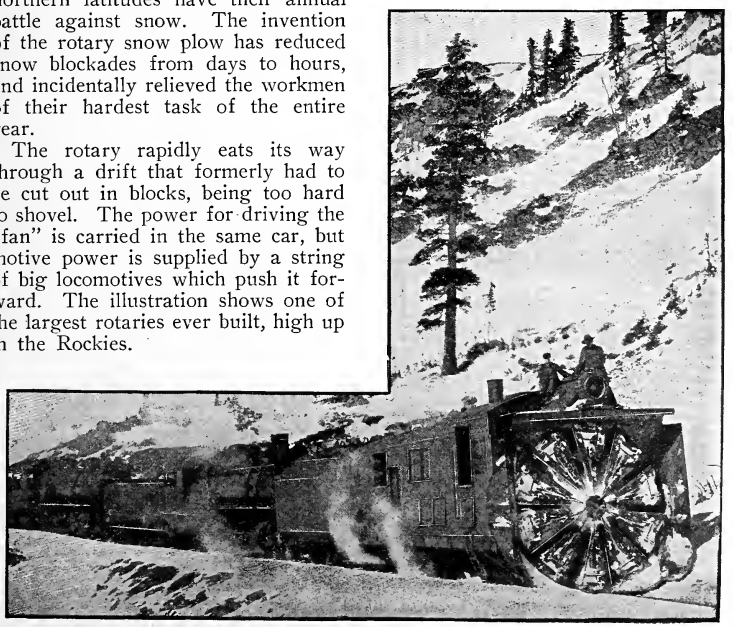
The rotary rapidly eats its way through a drift that formerly had to be cut out in blocks, being too hard to shovel. The power for driving the "fan" is carried in the same car, but motive power is supplied by a string of big locomotives which push it forward. The illustration shows one of the largest rotaries ever built, high up in the Rockies.

TO DAM THE SUSQUEHANNA

A great army of workers, 2,500 of them, are working to throw the greatest dam in this country, and one of the largest in the world, across the swift waters of the Susquehanna river. The power station, which will use the water power, will at the time of its completion this year, be the largest generating station of its kind in the world, the output being 100,000 hp., which is greater than the big plant at Niagara.

Current at high tension will be transmitted to Baltimore, 40 miles away; Philadelphia, 60 miles; Wilmington, 45 miles; York, 25 miles, and Lancaster, 18 miles. The enterprise will cost $10,000,000.

The dam will be 3,000 ft. long, from 40 ft. to 75 ft. high, and 68 ft. wide at the base. It will be one vast solid



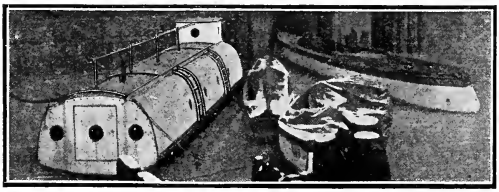
Resting After a Hard Run

block of concrete, of which 400,000 yds. will be used. The concrete is being manufactured at the work. A coffer dam already extends from one shore, laying bare a section of river bed which is being stripped to get down to solid work into which the dam will be anchored. In places the river is 60 ft. deep.

When completed, the dam will enlarge the river at that point to a lake 10 miles long, a mile wide, having an average depth of 30 ft. A good sized town has sprung into existence, with hotels, hospitals and stores.

NEW THEORY WHY WOOD WARPS

A new theory is advanced by hardwood experts as to why wood which has been carefully kiln-dried, often warps. It is now believed that when the sap is dried out various foreign substances other than turpentine, pitch, etc., remain in a more or less solid state; and when the wood is moistened these substances absorb water, and swelling, cause warping. A process is announced for removing



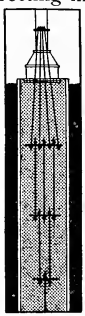
Built Entirely of Steel

the objectionable substances, the inventor claiming a piece of oak so treated can be soaked in water all night without swelling perceptibly.

Salton Sea, controlled at last by dams and soon to dry up, has changed the climate of its locality completely. What once was a desert is now a green country, refreshed by frequent rainfalls. The people are trying to have the sea preserved.

HOLDING DOWN A 40-STORY BUILDING

A 40-story building, such as is now erecting in New York, would seem to be heavy enough to hold itself down, and so it would be but for the terrible wind pressure. To counteract this force great steel rods, 3½ in. in diameter and sections of about 10 ft. each, are carried down 50 ft. into the cement foundations. The rods are anchored by plates and at the top converge in a single hollow column which extends to the top of the building. The foundations for a 40-story building are very costly, and twice as great as for a 20-story structure.



STEEL HOUSE BOAT

In a sheltered nook on the Chicago river, in the heart of the business section of the city, is anchored a new and novel type of house boat. The boat, which is the one at the left hand side of the illustration, is built entirely of steel, and the owner is a mechanic employed at a lighting plant fronting on the river. His spare time and money are put into the work of constructing the boat, the hull of which is now finished. The interior is being fitted up into several compartments, and is already occupied by the owner as a residence. Some day when the craft is finished he will float down to the Gulf of Mexico.

Experiments in Holland disclosed the fact that a parapet of sand backed by a wall of concrete increased the resistance to a shell about 20 per cent.

TWO BLIND MEN BUILD A HOUSE

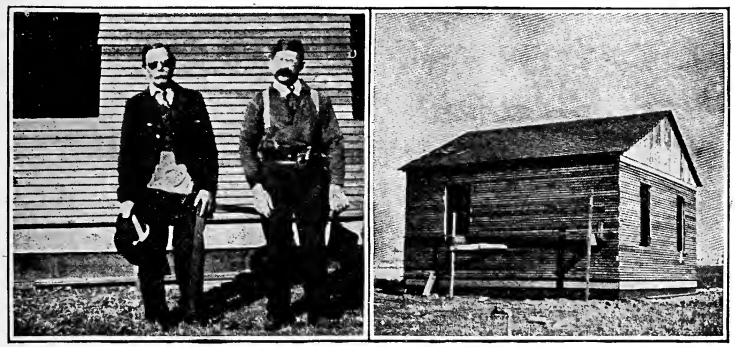
Doing all the Carpenter Work Without Assistance

Two totally blind men have built a house for themselves at Berkeley, Cal., doing all the carpenter work themselves without any assistance whatever. The event is one of the most remarkable accomplishments in building. Neither of the men will ever see the sightly structure they have raised.

It is a coincidence that both these men are named Joseph—Joseph Brown and Joseph Martinez. The house is of the popular bungalow type, 1½ stories high, and constructed entirely of wood. It is 18 ft. wide by 25 ft. long. As the builders are sightless, the work necessarily progressed slowly. From early morning until frequently long after sunset the two men toiled patiently at their task. The shades of night did not hinder the work, for noonday and midnight are equally dark to them, and out of the blackness came the song of the saw and the blows of hammer to passers-by, who heard but saw no workmen.

The bungalow presents a very neat and attractive appearance, all the work having been performed along strictly mechanical lines.

Though totally blind these builders have closely followed the square and plumb—sawing accurately to the line and driving straight home every nail. Each angle is perfect; the vertical and horizontal parts of the building are very accurate—surprisingly so. How sightless workmen could accomplish such perfect mechanical results seems little short of marvelous. From day to day the work has been curiously watched by crowds including many carpenters. The general work is pronounced as good as that performed by many builders who are blessed with perfect eyesight. These sightless workmen were not even afraid to climb the ladders when constructing the roof. In all the work the builders have received no assistance or suggestions.



The Blind Builders and the House They are Building

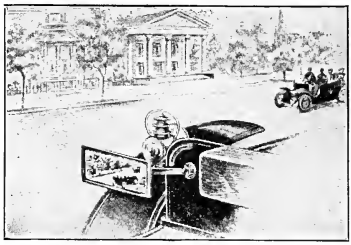
* * *

Brown and Martinez were not blind from their birth, but were deprived of their sight many years ago. They were door to door pedlars for many years, and managed in the course of time to accumulate snug sums of money that were wisely deposited in bank. At the time of the great fire

in San Francisco these men lost everything save their little bank accounts. Recently they pooled their holdings, purchased a small lot in Berkeley, and some lumber. They then set to work resolutely and have built themselves a house.

MIRROR FOR AUTOMOBILES

The latest accessory for the automobile is a small mirror set in a strong frame and suitably protected at the



"Looking Backward"

back, and placed where the driver can watch it. The mirror enables the occupants of a car to see what is coming from behind without turning the head.

CAR FOR INVALIDS

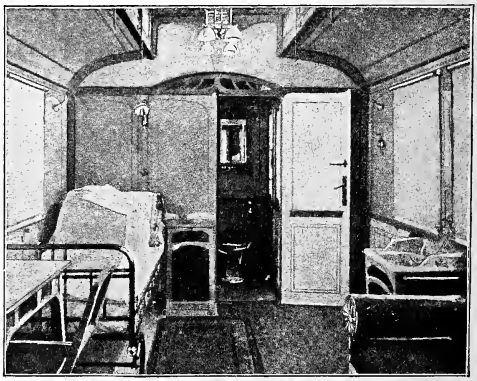
A car for the exclusive use of invalids and their attendants is a part of the regular equipment of the Hungarian State Railways, which are operated by the government. These cars were designed and built with a special view to comfort and privacy. The illustration from Locomotive, London, gives an idea of the interior of one of these compartments, of which there are several in a car. One room is equipped as a dispensary. Should a passenger be taken seriously ill while on the train he can be removed to the car and receive medical assistance without delay. Such a car, or at least a part of one car, would seem to be an improvement on our present overland trains.

WORKS TO SAVE STEEL FROM RUINS

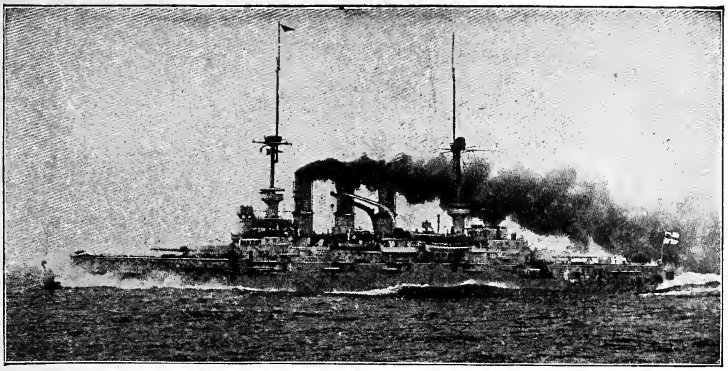
Sixty million pounds of iron and steel, taken from the ruins of San Francisco, are to be melted into ingots during the next two years and the recovery of this "junk" will mark the creation of a new industry. A great plant with enormous furnaces is being constructed on the Pacific Coast and a year's supply—50,000 tons—of the wrecked girders and beams is being laid in. About 1,000 men will be employed.

One of the difficult problems of San Francisco's reconstruction has been how to get rid of the twisted steel and iron skeletons that remained. The new industry solves the problem and opens up other possibilities for utilizing waste.

The fire loss in United States and Canada for October was $13,872,000; for 10 months of 1906, $414,460,000.



Compartment in Invalid's Car



GERMAN FIRST-CLASS BATTLESHIP "DEUTSCHLAND"; 13,200 tons; 16,890-I. H. P.; speed 18.85 knots. Armor Protection:—Water-line belt, 9.75-in. Krupp steel amidships tapering to 4-in. at ends; side above belt, 8-in.; main barbettes and turrets, 11-in.; casemates and battery, 6.75-in; armored deck, 3-in. Armament:—Four 11-in. 40-cal. guns; fourteen 6.7-in. 40-cal.; twenty 24-pdr.; four 1-pdr.; and four machine guns. Six submerged torpedo tubes.—Courtesy Journal U. S. Artillery Association.

CUTTING STEEL BY MEANS OF HEAT

In most operations there are extremes to be avoided and a happy medium to be determined, if possible, and adopted, but in cutting steel with circular saws there seems to be no happy medium. If a saw is given a cutting speed of 20 to 25 ft. a minute it will cut the steel without any difficulty, or if the same saw is given a speed of 2 miles a minute it will also cut the steel successfully, but at an intermediate speed, such as 500 ft., it will not cut well at all.

In the first case, where the slow speed is used, the saw cuts the steel by taking off small shavings like any ordinary cutting tool, while with the high speed the steel becomes red hot and is practically torn through, but with the intermediate speed the friction is not sufficient to produce the necessary heat before the saw is broken.

In cutting large sections of steel, such as large I-beams and heavy shafting, a soft steel saw without teeth is sometimes used. This revolves at a very high speed and is literally pushed through the metal, which becomes red hot. It is the common practice, however, to first make a number of nicks on the circumference with a cold chisel.

Another method of cutting steel, which has been used successfully for cutting pipe, was recently patented in this country by a Belgian engineer. The process consists in first heating the metal by means of an oxy-hydrogen flame and then cutting it by a small stream of oxygen gas, which unites with the steel and forms a fusible oxide; in this condition it flows freely from the cut.

The operation is made continuous by revolving the pipe and employing two jets; one containing oxygen and hydrogen and the other containing pure oxygen, which follows close in the path of the former. The oxy-hydrogen flame raises the metal to a red heat and the following stream of oxygen then makes the cut. It is said that the cut is fully as smooth as that made by a saw and is only 1/100 of an inch wide.

CEMENT HOUSES IN ONE PIECE

Walls, Floors, Partitions, Mantels and Roofs, All Cement

In a recent issue of this magazine Thomas A. Edison predicted the casting in molds with cement of a quite elaborate residence. The plan has already been put into practice in the construction of 50 two-story cottages in Pittsburg, where the process is called the "monocast" system. The foundations, walls, floors, partitions and roof are all cement. The Cement Era says "floor, walls and ceilings are all in one piece; grates are built into every room, and mantels are molded in on the walls. Shelving and cabinets are built in and sinks, bath and wash tubs are made in the house better than can be bought at any plumber's; all of concrete."

The only wood is in the doors and window frames, and a local architect is already taking out patents on cement doors and window frames. The doors are no thicker than the ordinary wooden door, but little heavier, and are immune to kicks from the small boy.

The forms are made of cheap cull lumber and can be used over and over again.

STEEL DREDGES TO WORK THE YUKON

A mammoth dredge with capacity for handling 2,500 cu. yd. of material daily is now on its way into the Yukon territory. It will take the dredge 90 days to reach its destination and by the time it arrives its cost will approximate $140,000. Manganese steel, which is to cast iron in strength as ten to one, has been used in the construction throughout and the dredge is said to be a marvel.

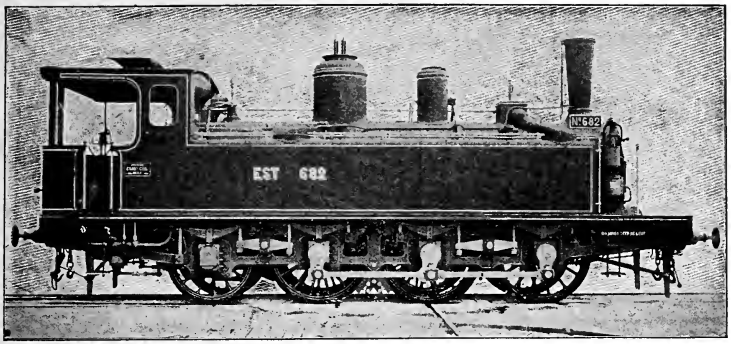
A number of dredges are now in successful operation along the upper Yukon. The initial cost, because of the difficulties of transportation into the frozen north, is almost prohibitive, but once on the ground the machines rapidly pay for themselves.

House Cast in One Piece

Cement is taking the place of adobe in many cities where adobe has been the building material for centuries.

TOO DAMP FOR THE DIVER

DIVER (who has just come to the surface and discovered that it is raining heavily): "Just pit ma head-piece on aga'n an' A'll get doon oot the wet!"—Black and White.



NOTABLE FOREIGN LOCOMOTIVES—Suburban Tank Locomotive, Eastern Railway of France. These engines work local trains on the lines out of Paris

ONLY HIGH EXPLOSIVES SUITABLE TO CHECK CONFLAGRATIONS

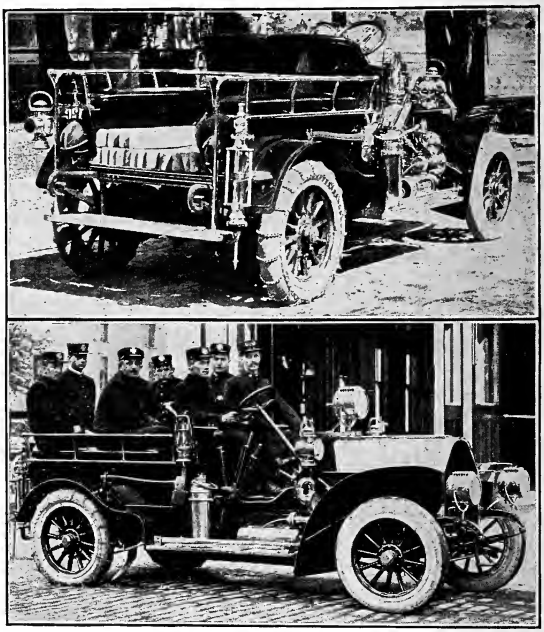
By P. H. Shaughnessy, Chief San Francisco Fire Department

Dynamite was used in great quantity to subdue the flames that swept over the city. In the hands of competent persons the explosive is a valuable auxiliary in fighting fire when other means fail. Our department gained valuable experience in the handling of dynamite, and I trust that other departments may profit by our observations. In the first place, dynamite should be stored in an isolated spot and under the control of the United States Army. It should never be brought into use until ordered by the chief of the fire department, and then it should be handled by trained men, preferably soldiers, commanded by competent officers. Great harm was done during the first days of the fire by the indiscriminate use of black powder. It developed that when black powder was exploded it threw off a combustion that ignited all woodwork with which it came in contact, thus starting additional fires. Giant powder, made of nitro-glycerine, was also used with the same results. On the third day of the conflagration 75 per cent dynamite, in stick form, was used with splendid results, as there was no combustion, and the buildings were leveled without danger. I would therefore recommend the use of stick dynamite, gun cotton or other truly high explosives that throw off no combustion, as the only means of checking a tremendous fire when water is not obtainable, as it levels a building to where you can deliver water to control the flames of such buildings of frame or brick of ordinary construction, containing wooden floor joints and wooden dividing partitions. I would not recommend dynamite to level buildings of "Class A," construction which are of the skeleton type, with steel frame and floors riveted at all junction points, for the reason that it would take an enormous quantity to level a building of that construction. I would further recommend that when dynamite is used that it should be exploded by electricity, as with the fuse system there is danger of not exploding when expected.

HIGH-SPEED EMERGENCY FIRE CAR

Instead of adding more men to each station of its fire department, as at first seemed necessary, Springfield, Mass., has established an entirely new department, consisting of a 40-hp. motor car and crew of eight men.

The fire car is located at the central station and answers every alarm, and often is able to extinguish the blaze before the engines arrive. The car carries such fire-fighting equipment as is suitable. On each side of the front seat is fitted a chemical tank, fastened by an easily detachable clamp. The axes are carried on the side of the body, and the hand spikes and crowbars on the running board. On the floor of the car is coiled 200 ft. of regulation hose, and at the rear on the right side the necessary nozzle. Snap fastenings are also provided for carrying the firemen's helmets, while hand lanterns are suspended and fastened to brackets by the side of the operator. The car is equipped with the regular side oil and tail lights, two gas headlights, and a gas searchlight fastened to the dash, the latter three being supplied by gas from a supply carried in a compressed form in a steel tank on the right side of the car. In addition to the hand horn a siren is also provided, which is operated electrically. Weed chains are used on both rear wheels, while just forward of the latter is provided a sand box with two outlets, the outlets being controlled by the operator. This is rendered necessary from the fact that Springfield's streets are paved with wood blocks, and consequently when coated with mud are somewhat slippery. The eight men composing the crew were individually trained in the use of the car, so that each may be called an expert. It had been estimated that 20 more men were required in the force but the car with only eight men additional sufficed.



This Company Answers Every Alarm

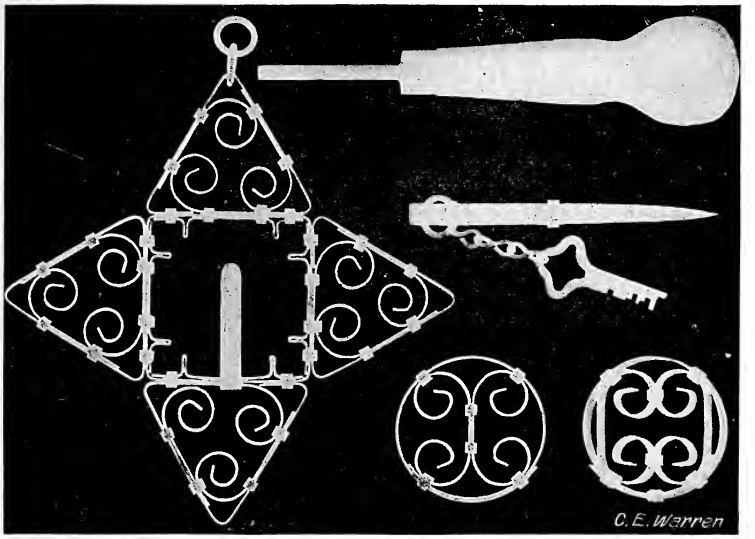
At the Krupp works, and its ore and coal mines are employed 62,000 persons, of whom 5,000 are officials and clerks.

The current of the Nile at the Assouan dam is so strong that a boulder weighing 60 tons has been dislodged from its bed and hurled against the masonry.

SHADOWGRAPHS AND HOW TO MAKE THEM

By Charles Everett Warren, M D.

Casting about for a simple, easy, quick and accurate means of making a number of records of designs for bent iron patterns, I accidentally struck upon the following method of blueprinting, which is applicable to a number of purposes where an outline is desired:



Shadowgraphs Reduced One-Half Actual Size

If the object to be sun printed is simply laid on a board over a sheet of ferro-prussiate paper, sensitized side up and held in place by common pins pushed into the board through the paper, close to the object and standing vertically, it may be exposed to the direct sunlight and a print taken; but there will be an effect of more or less shade, since the eye cannot judge the angle of sunlight correctly in relation to the plane of the board.

To obtain a perfectly clear outline, without shade, make a board with an arrangement for tilting it at any angle, a ball and socket joint being preferred, and drive a long, slim, steel wire nail near one end and perfectly perpendicular to the surface. The shadow of the nail head will then indicate when the board is perpendicular to the sun's rays.

For paper I use heavy ledger stock. The sensitizing solution is as follows:

A. Ferricyanide of potassium ¼ oz.
Water ..... 1½ oz.

B. Citrate of iron and ammonia .....150 gr
Water ..... 1½ oz.

Wine Glass and Bronze Statue—One-Half Size

Dissolve each separately and mix. If put in an amber colored bottle it will keep some time. But the paper should be used within a day or two after coating. For this reason prepare only sufficient for present use.

This is done in dim light, with a wad of cotton wool, spreading the solution evenly with long sweeps, the paper being laid on a board. It is then hung up in a dark place to dry. This, by the way, is an excellent formula for printing photos, if a fairly dense and vigorous negative is used, and may be of use for making postcards if the stock is glazed; otherwise the solution will sink into the card.

Expose to bright sunlight until the paper not covered by object is a dull gray for deep blue or a bronze blue for light blue when developed. Develop in water, remembering that the full strength of color is developed by fairly long immersion. Rinse several times to insure perfect removal of all ferro-prussiate, or the print will not be permanent. Dry out the superfluous moisture by laying in an old newspaper and then remove to dry newspaper and dry under a weight.

If the slight print of the pin heads is objectionable, cut them off with cutting pliers after they are in place or use pliers to insert them. I have found a thimble on the index finger a help, as it prevents sore fingers. Be sure to drive the pins firmly, and in a vertical position, close to the object to be held, as the board must be inclined and the weight may cause the object to fall off if it is not securely fastened.

The preparation of the object for exposure may be done in a dimly lighted room without causing any appreciable effect on the objective result. If the object does not have a flat side, but tends to tilt, put bits of cork of the right height under it or drive in a pin and cut off the head to leave it of sufficient height to act as a support.

This method was originally adopted to copy designs of scroll work made from ¼-in. iron tape, but it has been found by experiment to be applicable for printing cylindrical and irregular objects of some thickness, such as tool handles and the like. Hence it is an easy and accurate method of getting template prints, which may be cut accurately to line.

Corrections in the blueprints or additional white lines or legends may be inserted by using a saturated solution of bicarbonate of soda as ink. If a little gum arabic is added to it it will flow better.

Line drawings may be made by printing and developing in the usual way. Line in all the parts desired with waterproof black ink and when dry immerse the print in a solution of bicarbonate of soda, and the blue ground will disappear, leaving a black line drawing on a white ground.

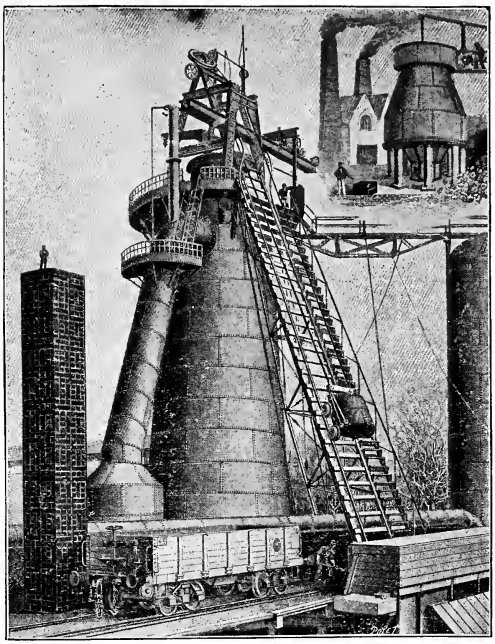
DIVER READS UNDER WATER

To test the qualities of a submarine electric light a diver at Aberdeen, Scotland, descended 20 ft. in muddy water taking a newspaper and the light down with him. While seated on an anchor at the bottom of the harbor he read aloud for ten minutes to the men above, the words being conveyed through the telephone in his helmet. The paper was held 18 in. from the lamp.

DEVELOPMENT OF THE FRENCH BLAST FURNACE

A French writer in La Nature reviews the progress of the iron industry in his country. Until within the past few years the old type furnace was generally employed, having a capacity of 6 to 10 tons production per day. Even now there are many of these small plants, limited to an output of 24 tons daily.

The artist has portrayed the small furnace with the man pointing to the small pile of pig iron, and also the modern French plant with an output of 700 tons per day, in which the product is represented by the tall square shaft on which a man is standing. In 1848 the French produced 500,000 tons of iron; last year, 5,000,000 tons.



Showing Growth of Iron Industry in France

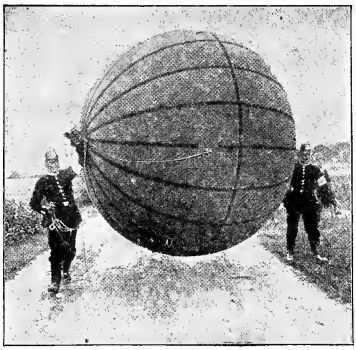
CARD SHUFFLER

A machine which automatically shuffles a pack of cards in an instant, with the cards concealed from sight, and which changes the position of 99 out of every 100 cards, is the latest mechanical device for card players. It not only protects the cards from injury but gives an absolutely "square deal" shuffle.

The machine weighs 4 lb. and attaches in a moment to any table. It is about 12 in. high.

A FIRE-PROOF BRICK

A glass company at Monterey, Cal., reports the discovery of materials and a process of manufacture which produce a remarkable brick. The chief materials are magnesia and silica rock, which when ground and mixed with secret ingredients rapidly hardens in the air, and becomes a non-conductor of heat, cold and sound. A sample, 2 in. long, was exposed at one end to an intensely hot flame for 10 minutes and could then be held in the hand by taking hold of the other end. When subjected to a strong blow-pipe flame and suddenly plunged in cold water no injury was detected. It is said the cost of making is no greater than the ordinary clay brick.



SIGNAL BALLOONS

The illustration shows one of the signal balloons now in use in the German army. They are not intended for passengers but are sent up with signal flags and cones used in connection with a secret code.

ELECTRICAL DEVICE TO PREVENT SEASICKNESS

The terrors of a sea voyage, due to seasickness, are said to have been entirely overcome by a recent invention of Herr Paul Kappmeir. The accompanying illustration, from the American Inventor, shows a new electrical device as placed in position on the head of a patient suffering from seasickness.

The inventor of this device, after having made numerous experiments and exhaustive researches, came to the conclusion that seasickness is caused by acute cerebral impression in combination with reflex irritation of certain nerves in the head, which results in a disordered circulation and an abnormal flow of blood from the head to the gastric regions.

The Electric Cap

In order to disprove the old theory that seasickness is caused by the contents of the stomach being continually washed against its walls, an experiment was tried in which a susceptible patient developed all the symptoms of seasickness while in a perfectly stationary position. This was accomplished by means of an optical illusion, the rolling motion of the boat being simulated by moving mirrors. Thus by visible impressions the feeling of equilibrium, in the same way as in the initial stage of seasickness, is disturbed in the reflex centers, but after a time, and also upon subsequent repetition by tolerance and habit, accommodation slowly begins, in the same manner that on ship-board the eye slowly accustoms itself to everything around it being in motion.

The electric cap consists of a compress, which produces both heat and pressure, thereby paralyzing the vasomotor nerves, which control the supply of blood to the head. This allows the normal amount of blood to flow to the head, thereby preventing the dizzy feeling and overcoming the distressing sensations in the stomach.

COAL MINING IN INDIA

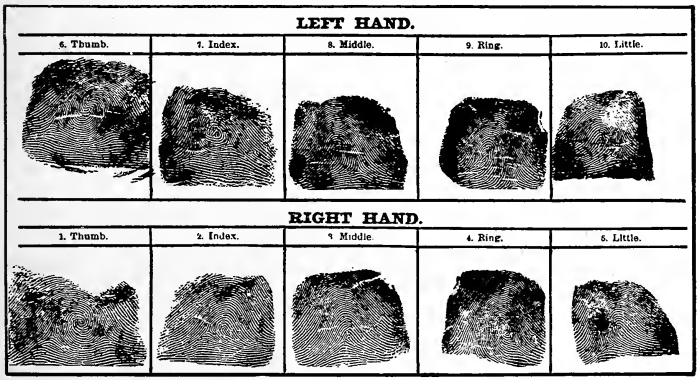
India has upward of 35,000 square miles of coal fields. The coal is an excellent quality of bituminous and now retails at about $3 per ton. At present mining is conducted in a very crude and unscientific manner, to remedy which the government has opened a college for training native engineers. Many women find employment in the mines.

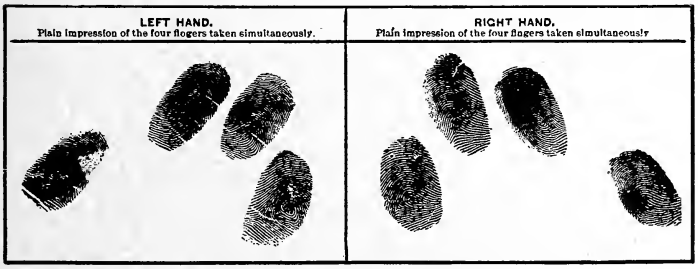
In the capital of India the coolie women carry bricks and mortar on their heads and climb bamboo ladders

to the third and fourth stories of buildings as helpers to coolie masons. These women sweep the streets and do all sorts of menial labor. They carry on their heads burdens seemingly large enough to bend the backs of bullocks and donkeys. Even girls of 8 and 10 years of age carry loads on their heads weighing 50 and more pounds and trudge along under the sun's intense rays with the mercury rising to 100° in the shade. An effort is being made to change these deplorable conditions.

SOLDIERS IDENTIFIED BY FINGER PRINTS

From Birth to Death the Same Pattern and in No Two Individuals Alike




LEFT HAND.
Plain impression of the four fingers taken simultaneously.
RIGHT HAND.
Plain impression of the four fingers taken simultaneously

The finger prints of every individual are distinctively and exclusively his very own. In eyes, nose, hair, even the entire face, he may so closely resemble some other man, as scarcely to be distinguished from him. In fact, the statement is made that somewhere in the world there is always a "double" for every one. But the patterns made by the little lines in the pulpy ends of the fingers never conflict. Not only do these prints differ in men, but the lines on each of your ten fingers are different from each of the other nine fingers. The discovery of these facts is now employed in a system of identification which is absolute and permits of an

enormous number of combinations. The finger print identification is an outgrowth of the Bertillion system, but has many advantages. A change in whiskers, the removal of a mole or tooth is easily accomplished and makes a stranger of an oldtime friend. Many a man has shaved his beard and had his own children deny his identity. The color of hair, and even of the eyes, alters during life, as may one's gestures, features and handwriting; but throughout an entire life and even after death, the little ridges on the finger ends alone remain true and unchanged to the patterns which only a microscope can discern on a baby's hand. The War Department has now adopted a finger print record and every man who enlists has his record taken and sent to headquarters at Washington. How this is done and what becomes of the records is described in detail by Maj. J. R. Kean, M. D., surgeon U. S. Army, in the Journal of the American Medical Association.

When a man enlists a front and side view photograph are made of him, with a camera which is the same as used at all other recruiting stations; the camera in every case being stationed 54 in. from the subject. This results in a uniform system of photographs. Impressions are then made on paper of each of the ten fingers, one at a time. The finger is pressed against an ink pad and gently held to the proper column of the record sheet for a moment. Then an impression is taken of all four fingers at one time, of each hand. A forward rolling motion is given the finger tip in making the print.

Should our soldier or sailor boy ever meet with death in battle, and every other mark of identification be destroyed, a print of even one of his fingers would enable the department to complete his record, and mark his honored grave with his name, age, and company.

The reading of a print is really a remarkable performance; in other words taking a finger print and identifying its owner. This is done by experts at headquarters. In filing, a division is first made of two general classes, loops and whorls. In the former are included the arches and in the latter the composites. Each of the ten prints will be there, either a loop or a whorl, designated L or W, respectively, and the ten digits, being taken in pairs, there will be four possible combinations of each pair, which are written as a key thus:

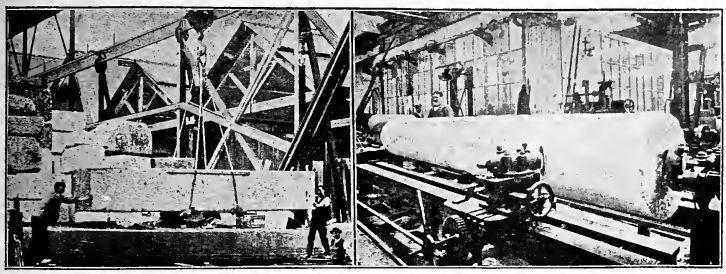
LL	LW
WL	WW

The classification is then extended to its limit, and so perfect is the work that an expert can find and identify a print by its owner's name in a section containing 100,000 cards, in five or six minutes.

Major Kean says: "This system will be very valuable in obviating the necessity of much correspondence and collection of evidence at present required to prove identity in cases coming before the War Department and the Pension Bureau. After the introduction of this system, any man who has had service in the Regular Army, can at once establish his identity by placing his right forefinger on the ink pad of an ordinary rubber stamp and making a finger print below his name. Unknown dead, or unconscious men, brought from the battlefields into field hospitals, or who die there, can in this way give a record which will lead to their identification; and a copy of the finger print buried in a vial with the body will be a permanent identification of it."

Don't try to use an incandescent light too long, as it grows old you are using just as much current and getting less light all the time; 800 hours is usually long enough.

A telephone line has been built to the summit of Mount Graylock, the highest mountain in Massachusetts. Where the line makes a nearly vertical ascent for several hundred feet the wires are carried in an iron pipe.



From the time a block of stone weighing many tons is cut from the quarry until placed in position to ornament or support some great building, the work is practically all done by machinery. Two or three men with suitable hoisting apparatus handle these immense weights easily and safely. Pillars are turned in lathes, carborundum wheels driven by an electric motor taking the place of a steel knife; otherwise the process is quite similar to that of turning a table leg.

BOAT POLO FOR LADIES

Boat polo, which was introduced last summer in England, proved a great success, the game being full of excitement for both players and spectators.

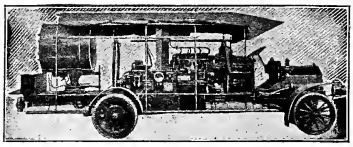
Specially built small boats are required and the player is allowed only one oar with which to guide the boat and play the ball. As the boats are easily and frequently capsized much skill is required, and the players must be good swimmers. The general rules of the game are the same as when played on land, but the playing is more interesting on account of the single oar. The frantic efforts to maintain the boat in position and strike the ball at the same time are extremely amusing.

"The Boats are Frequently Capsized"

Mme. Curie, the first woman to occupy a chair at the Sorbonne University, Paris, has opened her lectures on radio-activity.

DUPLEX WIRELESS SYSTEM

A new system of wireless telegraphy which was recently invented by Vladimir Poulsen, of Copenhagen, is said to have solved the troublesome problem of interference between stations while working simultaneously. In the new system a continuous flow of energy to the receiving apparatus has replaced the intermittent sparks used in other systems, and it is claimed that any number of stations within range of each other can intercommunicate without mutual interference.



PORTABLE ARMY SEARCHLIGHT

A powerful searchlight is the surest safeguard against a sudden night attack, and is now recognized as just as essential a part of an army outfit as its tents. The latest portable motor searchlight equipment for the British army is the large machine shown, the wheel base being 12 ft. The generating outfit for the searchlight is an independent motor of 35 hp. The projector is 36 in. diameter; an extra lens being carried.

A NATION ON WHEELS

The recent statement in these pages that there were in use today automobiles and motor cars to the value of $200,000,000, occasioned considerable surprise—and some doubters. When one realizes, however, that there are more than 100,000 of these machines, and that $2,000 would be a low rather than high average price, the figures are found to agree. This number and amount are the accumulations of several years, and not the production of the past 12 months.

In the line of vehicles drawn by animal power, including carriages, trucks, merchants' wagons, drays, farm wagons, etc., the annual production numbers nearly 2,000,000 vehicles, which with an average life of, say five years, would give for the entire country approximately 10,000,000 vehicles of one kind and another, and the capacity of the combined assortment is sufficient to give every man, woman and child in the entire United States a ride at the same time.

Evidently the motor car has some little distance to travel yet before the faithful horse and mule are entirely displaced.

HOW GOLD LEAF IS MADE

Why Gold-Beating Machines are Failures

Strange as it may appear, the process of beating gold has not been changed during the thousands of years in which it has been practiced. While nearly every other art and industry has been greatly benefited by the application of mechanical devices, the gold-beater has been constantly pounding away and furnishing the world with his splendid product, apparently indifferent to the mechanical progress that has been made in other directions.

The first operation in manufacturing gold leaf is the preparation of the metal. The gold is obtained originally in its pure state from the Philadelphia Mint and is then alloyed with ½ carat each of silver and copper, thus leaving the gold 23 carat fine. The object of adding this alloy is to increase the strength of the gold, which is very soft in the pure state.

The gold is melted in crucibles about 6 in. high which are placed in a small furnace where the metal melts at a yellow heat and is then poured into molds, in the form of bars about 10 in. by 1 in. by ½ in.

The Gold-Beater

The bars of gold are then passed between steel rollers and rolled into ribbon several hundred feet long and about an inch wide, the rollers being brought closer together after each operation, until the metal is as thin as paper. It is then cut into small squares ready for the first beating.

The first beating is done with a 16-lb. hammer. Two hundred pieces of sheet gold are placed between sheets of oiled paper, used exclusively for the purpose, the sheets being held together by two parchment bands. This forms a package 3½ in. square and about ¾ in. thick, known as a "cutch."

The cutch is then placed on a marble anvil sunk 3 ft. in the ground and is there hammered with the 16-lb. hammer, thus causing the gold to flatten and spread out between the sheets of oiled paper. When all the pieces have spread out evenly to the edges of the cutch they are taken out and each square is cut into four smaller squares.

The 800 pieces thus formed are placed in a package of oiled papers 4½ in. square called a "shoder." This is hammered with a 12-lb. hammer until the gold is driven beyond all four edges, the gold extending over the edges, known as "sfruf," being scraped off with a knife and saved to be melted over again.

The 800 large squares are then removed from between the oiled papers, placed, one at a time, on a leather cushion and cut into four smaller squares. The 3,200 leaves thus formed are placed in three packages of skins called "moles." These skins, which will be described later, serve in the same way as the oiled papers in the former operations, but are much smoother and present very little friction to the spreading gold. The moles are beaten on the marble anvil in the same manner as the cutch and shoder except that two hammers are used. The first beating is done with a 6-lb. hammer and is continued for two hours, after which the beating is continued with a 10-lb. hammer two hours longer.

The gold-beater examines the work from time to time by slipping off the parchment bands and turning over the edges of the skins, thus showing where the gold is spreading the least and enabling him to determine where to strike the greatest number of blows.

Gold-Beater's Tools

After the final beating the gold leaf is trimmed into 3⅜-in. squares which is the universal standard in all countries and it is then packed in books ready for the market.

Considerable time is required to learn all the branches of the gold-beater's art and an apprentice is not considered proficient until he has had at least four or five years experience. A complete knowledge of the peculiar properties of the gold-beater's skins is essential as the success of the

operation depends largely on their condition. These skins are obtained from the intestines of cattle, only one portion being suitable for the purpose, the size of which is barely sufficient to make one skin. Each mole or package of skins will therefore represent over 1,000 head of cattle.

Gold-beater's skins are now furnished exclusively by a London firm, who prepare them by a special process, which has been carefully guarded and kept a family secret for many generations. In Chicago the fresh skins are obtained from the stockyards and are then sent to the English firm where they undergo the secret process after which they are shipped back.

Before each beating the skins have to be carefully prepared by the gold-beater. They must be neither too hot nor too cold; must have just the right amount of moisture, and require more skill in their preparation than any other branch of the art.

If properly used and cared for one package of skins will give constant service for about a year and a half, but if given a single foul blow, i. e., struck with the edge of the hammer, the whole pack will be ruined. Overheating will also damage the skins and if carried too far will spoil them entirely.

The adhesive properties of gold leaf render it fatal if swallowed in sufficient quantities, and the nobility of China frequently commit suicide in this way, the gold leaf often completely covering the walls of the stomach and preventing nutrition.

The extreme thinness of gold leaf, 1/200,000 to 1/250,000 of an inch, makes it transparent to light, a single leaf, held between the eye and the light, having the appearance of green glass or very fine green gauze. It is so transparent that a person would have no difficulty in recognizing a friend by looking through it towards the light, but let a beam of light strike the side of the gold leaf on which the observer stands and it suddenly appears to be opaque. All objects appear to have a green color when viewed through a piece of gold leaf the same as when a piece of green glass is held to the eye.

In all industries where gold leaf is used care is taken to save all the scraps and waste, which are returned to the gold-beater to be remelted. Several bookbinders of this country realize in this way as much as $500 to $600 each month. The daily sweepings from gold-beating establishments are saved and sent to the smelter, as they are rich with gold.

Several machines have been designed for beating gold but none of them have met with any practical success. In discussing the possibilities of beating gold by machinery, Mr. A. H. Williams, one of the most practical gold-beating experts in this country, says:

"The process of beating gold today is the same as it was in King Soloman's time. No improvement in the art has been made since then nor are there indications of any for the future. It must be remembered that gold-beating is an art and that the apparent indecision with which the skilled gold beater strikes his work, is in reality the result of many years' experience. Thus it is that the true art hides itself and while to the ordinary observer the blows are simply given at random, the gold-beater must know just where to strike each blow in order to spread the gold successfully without pounding it full of holes.

"If the beating is done too fast the skins become overheated and the work is ruined. For this reason a machine even if successful would turn out no more work than a single operator and would therefore be more expensive than the present method.

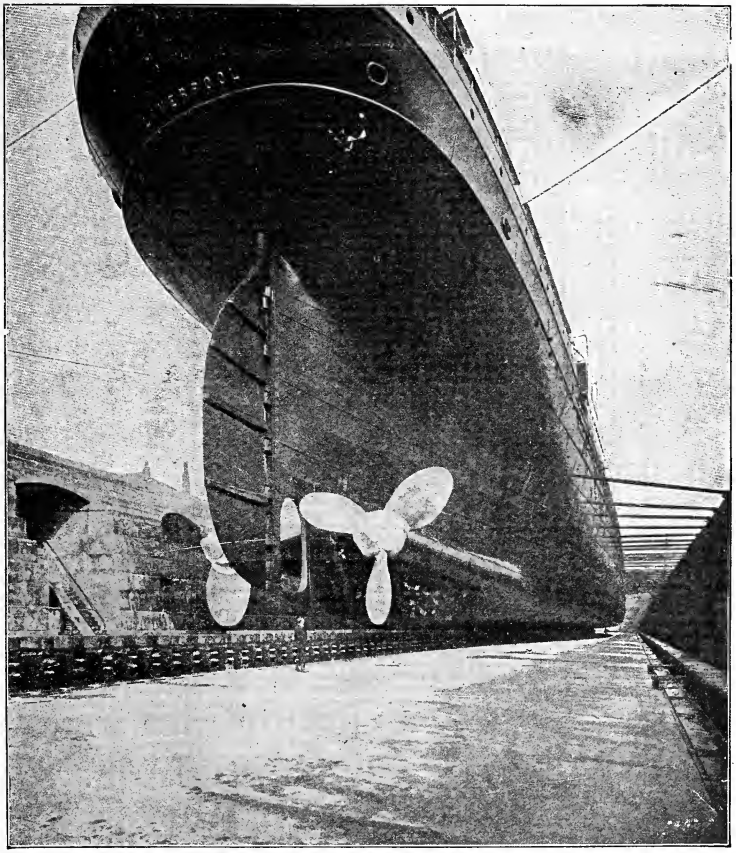
"I am of the opinion that the art of gold-beating has long past reached its final state of perfection. It would be a waste of time for any person to endeavor to invent a mechanical process to do the work who had not first become experienced in the present method."

GIANT SHIPS IN THEIR "BATH"

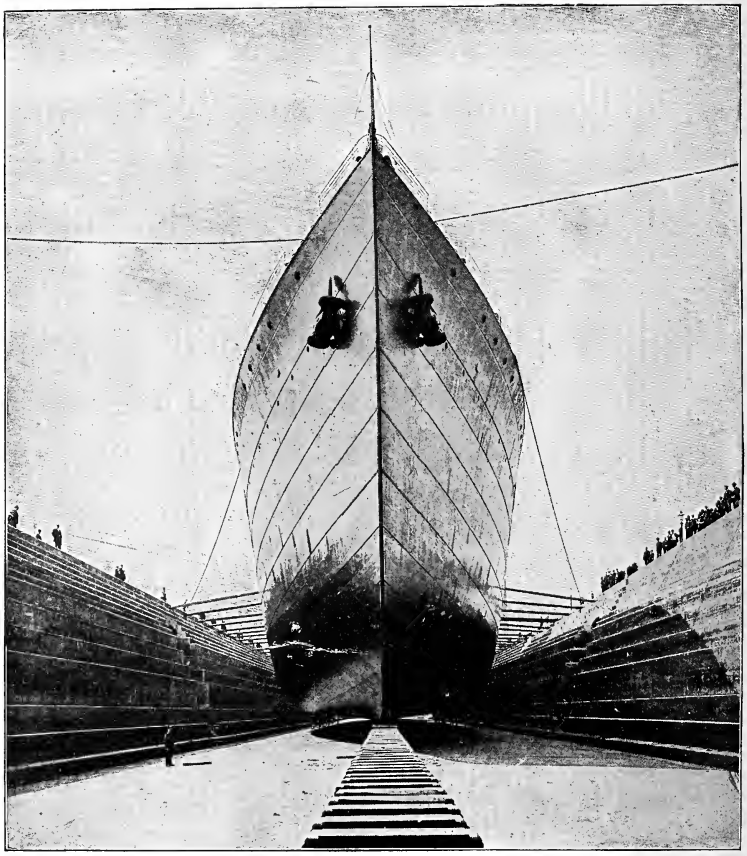
How the Colossal Floating Palaces are Taken out of the Water and Cleaned

There is such keen competition today among the great ocean-going lines that no matter how luxurious a 20,000-ton monster may be when she is first launched, all the vast expenditure upon her will go for naught unless she is kept keyed to the highest pitch of efficient perfection. She must keep her times in New York harbor and Liverpool as regularly as though she were an express train; and that in spite of icebergs, fogs, uncharted rocks, derelicts, and other menaces to navigation.

No sooner has she docked in Liverpool, and her immense population of



20,000-Ton "Oceanic" in Liverpool Dry Dock



Bow View of "Adriatic"—25,000 Tons—in Dry Dock

perhaps 3,000 souls streamed down the gangplank, than the overhauling begins. Silver-plate and linen, with china, books, furniture and a thousand other necessaries are checked and inventoried; and a whole army of decorators and stewards let loose among the nine decks that rise tier above tier to a height of 60 or 70 ft. above the water. The engineering staff, too, go over the mighty mechanism that may develop the strength of 70,000 horses, lest some rival liner do better than they, and fastidious passengers transfer their patronage. But most curious of all perhaps is the putting of the 20,000-ton monster in her "bath"! This bath is in reality a dry-dock, which in order to receive the leviathans of today conveniently must be fully 1,000 ft. long.

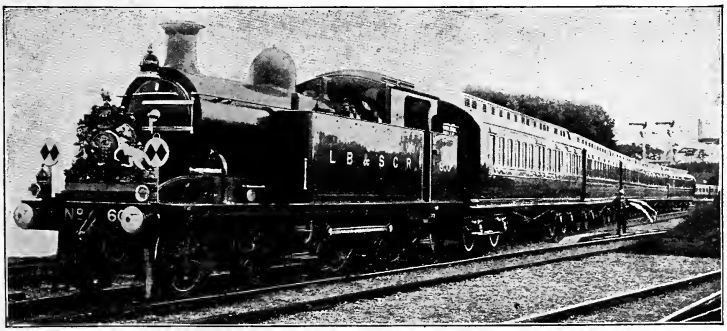
Just such a curious receptacle is the famous Canada dry-dock in Liverpool, where all the most magnificent liners of today are overhauled. One can imagine no more delicate operation than landing a great liner on the elm and

oak blocks at the bottom of this bath. While yet the monster is floating in deep water a plan of the bed arrangements is submitted to the chief officer, and very careful calculations are made so that the stupendous hull may rest evenly upon the blocks. Then the flood gates are opened and the bath filled. When its level is the same as that of the outer water, the colossus is wheeled round and her nose pointed in. Then tugs begin to haul in, and when once her towering bow is between the amphitheater-like walls, her speed is so slow that it takes a sharp eye to detect any movement at all.

You understand that if she scraped her sides it would do great damage. No sooner is she fairly in, than a whole army of men get to work with brushes of steel wire on the ends of long poles; and when at length the stern and propellers are inside, the outer gates of the bath are closed and enormous steam pumps get to work throwing out millions of gallons. Gradually the mighty ship sinks, and as she goes lower and lower consultations are held as to how likely she is to settle on an even keel on the blocks prepared for her. Moreover long poles are stretched from the walls, so that when she comes to rest she may not heel over either way. The breaking of these poles would surely result in disaster, entailing scores of thousands of dollars to put right.

Remember, the ship may be nearly 800 ft. long, and the dead weight in the case of the new Cunard liners "Lusitania" and "Mauretania" is 33,000 tons! At last every drop of water is removed from the bath, and scrapers, brushers and painters get to work on the towering steel flanks of the ship. She has settled on her bed within a fraction of an inch of the spot designed for her, and you will soon see busy men, perched like acrobats and looking like flies on a wall, on narrow planks high up on the hull, driving rivets, testing plates, painting or scraping. A ship like the "Mauretania," by the way, contains over 4,000,000 rivets, and the largest of them are 8 in. long and weigh nearly 3 lb. The removal of weeds, barnacles and other marine growths from the hull of one of these magnificent liners means a material increase of her speed.

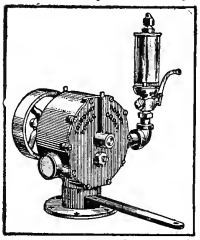
At last the floodgates are opened once more, and gradually the monster lifts off the blocks, and is hauled out again with as much care as she was hauled in. A whole fleet of tugs are fussing about her; her head is swung round, and, all spick and span both within and without, she is ready to receive her thousands of passengers and poke her nose out once more into the stormy Atlantic for another journey of 3,000 miles.



Royal Train Used by the King between London and Epsom Race Course

MOTOR BOAT WHISTLE

A new whistle for motorboats is sounded by a rotary blower driven by a friction contact with the flywheel of the engine. The whistle can be maintained as long as desired and the sound is uniform and steady. The blower, of course, must be at the engine, but by use of piping, the whistle can be placed anywhere in the boat and a whistle cord run to the steering wheel.

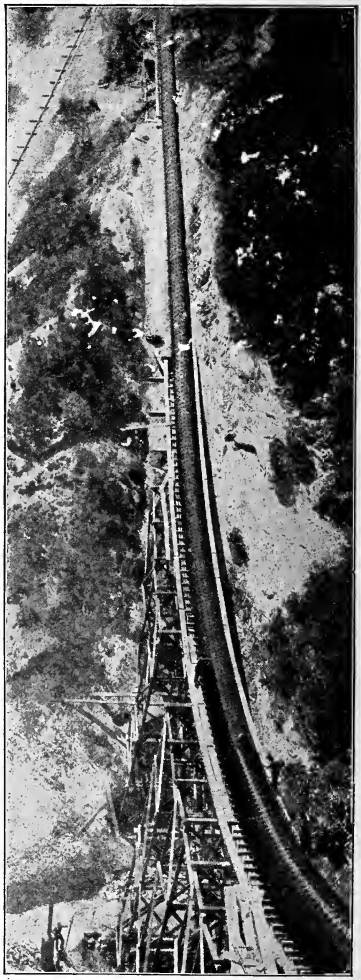


PIPING WATER ACROSS THE MOUNTAINS IN HUGE WOODEN PIPES

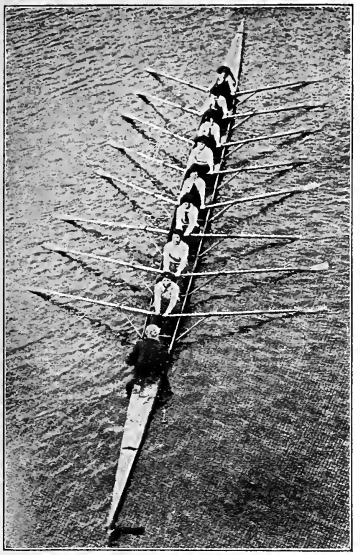
In California there are many great irrigation, mining and water-power enterprises, and as more than four-fifths of the state is mountainous, water in not a few cases has to be taken over high rocky ridges and across deep ravines and canyons. In order to conduct water over such a rough country huge wooden pipes, more than 6 ft. in diameter, are used.

These pipes are made of redwood staves banded by iron rods that may be tightened by screws and the pipes thus made watertight. California redwood is found to be an excellent material for making water pipes, for the reason that a large proportion of lumber from that tree is "clear stuff," free from knots, pitch and pitch seams, and the wood being very free from sap is enabled to resist decay to a remarkable degree.

The wood stave pipe is found far preferable to iron or steel pipe for construction in mountainous regions, for the reason of its light weight, and that the material may be transported to the site of operations in pieces. It is not infrequently the case that it is found impossible to transport even this light material upon wagons, so rugged is the country, and in cases of this kind the wood staves are lashed to the backs of burros and thus taken into the steep places. Our illustration shows a section of this huge pipe descending a steep mountain side and crossing the gulch at the bottom.



Pipe is 6 Ft. Diameter



GIRLS' FIRST RACING SCULLING EIGHT

Dr. Furnivall, the eminent Shakespearean scholar, claims his crew of girls is the first racing sculling eight to be pulled by women, and that the American girls' eight is a rowing, not a sculling eight. The illustration shows his crew of fair oarswomen in full swing in their racing scull on the Thames river.

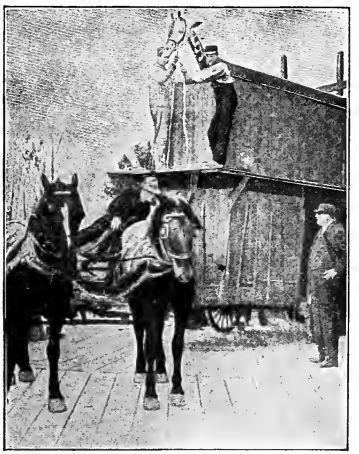
MACHINE TO TYPEWRITE 1,000 WORDS A MINUTE

Remarkable claims are made by the inventor for a new automatic typewriter which is to be placed on exhibition. If its construction is such as not to require an engineer, electrician and a crew of machinists in constant attendance, and it will do one-half it promises, it will revolutionize correspondence in large establishments. The inventor says:

"This machine will actually write letters at the rate of 1,000 words a minute. The machine may be operated in two ways. If it is desired to make a number of copies of the same letter with different names and addresses it will perform this work, producing in each case an original letter in one, two or three colors, fill in the name and address and add the signature. A business man desiring to dictate may use this automatic typewriter by talking his letters into a device like the phonograph, transfer the record to the machine, turn on the electric current and go home. The next morning the letters will all be done and the machine will automatically stop when all the letters are written. It will also address envelopes or wrappers and count them as well. It will write forwards or backwards, and, if desired, the lines may be justified like type.

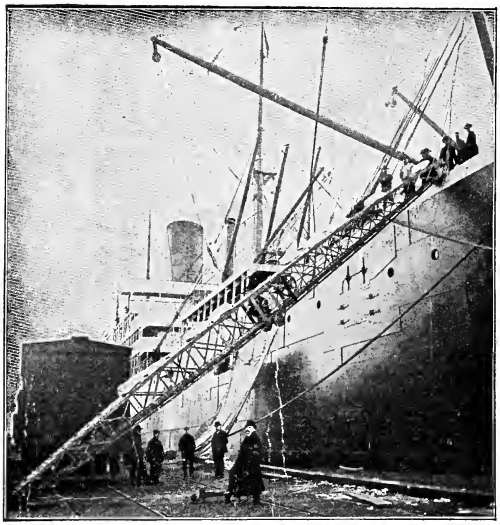
CAR DITCHED; TRUCK WENT ON

The motorman on an interurban line near Grand Haven, Mich., forgot to shut off the current as his car approached a curve at high speed. The result was the car body was thrown completely off the trucks which remained on the track and ran 1,500 ft. before coming to a stop.



Peculiar vehicle specially constructed for the transportation of giraffes. The top of the wagon is about 20 ft. above the pavement.

AN ELECTRIC CONVEYER FOR SHIPS



Courtesy Spence Mfg. Co.

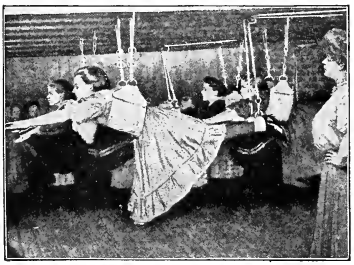
Loads 5,000 Packages an Hour

Electricity plays an important part in the loading and unloading of modern vessels. It is claimed that the conveyer shown in the illustration will save $50 to $65 per day, doing the work formerly done by hand.

It is electrically driven and has an endless wooden apron which runs on steel rollers. It operates at any angle, is from 25 to 50 ft. in length and can be transported to any place. There is an automatic registering device which accounts for every package, no matter how small, that passes over it. The conveyer will transport and register from 3,000 to 5,000 sacks, cases, barrels, bundles of shingles or bales per hour, according to size and weight. The illustration shows a 50-ft. machine loading the steamship "Minnesota" at Seattle.

TEACH SWIMMING ON DRY LAND

By means of a new invention school children in Germany are being taught how to swim before they enter the water. The apparatus consists of a broad sling placed under the chest and a narrow band for each ankle, allowing free movement of the arms and legs. The leg slings are balanced on weights and pulleys to allow a compensating motion.



German Swimming School

MINING KAOLIN WITH WATER JET

A company mining kaolin in Connecticut successfully uses a water jet instead of a shaft. A 4-in. pipe is put down to the bottom of the kaolin bed, about 200 ft. Inside this pipe a 2-in. pipe is let down with a nozzle at the lower end, through which water is forced at a pressure of 60 lb. About 100 gal. of water and kaolin per minute come to the surface, 10% being solid matter, of which 75% is kaolin. The discharge is then pumped 4 miles through pipe line to washing plant.

A railroad brakeman has invented a hot-box alarm, in which the melting of a fuse rings a bell in the coach.

An exhibition of Japanese daylight fireworks in which thousands of subjects, made of colored paper, are fired into the air. Animals, fish, balloons, furniture, umbrellas, and countless other objects are sent up several hundred feet and float slowly down, unfolding as they descend.

IN THE STOKE HOLD

What is doubtless the fiercest work performed by man is firing the furnaces of the great ocean liners, which consume several hundred tons a day. The men are obliged to work incessantly in a temperature which few people can endure longer than a few minutes. Although they work in short shifts it is so exhausting that the men are short lived, and new stokers have to be secured constantly to take the place of those who have become broken-down wrecks.

Man-Killing Work

PECULIAR WRECK OF BUILDING

A three-story frame tenement whose height had been increased by raising on jack screws preparatory to moving, was blown down in Chicago.

A midnight gale blowing nearly 50 miles an hour overturned the building; five persons were killed and 16 badly injured. The collapse of the structure was almost complete as seen in the illustration.

A pile driver at New Orleans is 108 ft. high; supposed to be the highest ever built.

MINER'S LIFE-SAVING HELMET

Several types of life-saving helmets are already in use by miners and firemen and in refrigerating plants. The

Working in Deadly Gases

latest device is a German invention, in which the air supply comes from two oxygen cylinders strapped on the back.

A special diving helmet is also made for submarines. It can be put on in one minute and will sustain life while the wearer dives from the boat and makes his way to the surface.

SEE-SAW TARGET FOR BIG GUNS

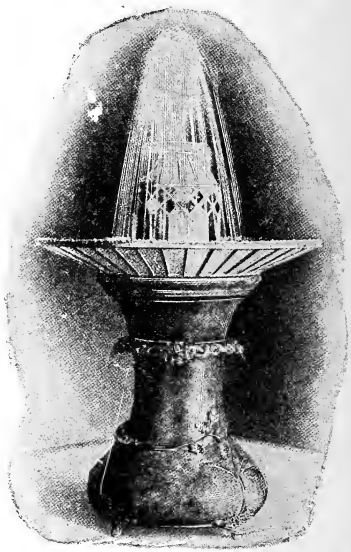
One of the most unique targets ever devised is in use at the greatest school of naval gunnery in the world—Whale Island, Portsmouth, Eng. Here the seamen and coast defense gunners are educated.

A Target Hard to Hit

The target consists of two dummy warships oscillating on an immense steel beam. This imitates the pitching of a vessel in a heavy sea. At the same time the car on which the target is carried moves back and forth, giving motion in two directions at the same moment. At this elusive target the gunners fire.

ELECTRIC TABLE FOUNTAIN

The latest ornament for a banquet table is the electric fountain which throws dainty streams of perfumed water, through which glimmer the soft rays of colored lights.



Elect ic Table Fountain

The fountain can be moved about like a table lamp, and takes current through a flexible wire cord. A small electric motor drives a centrifugal pump to keep the fountain playing.

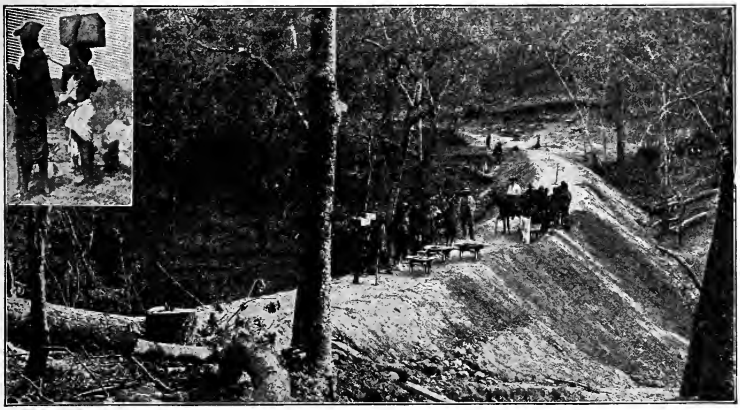
A New York steeplejack, after years of perilous adventures on the tallest spires and stacks in the city, fell 4 ft. and died from the injury.

BUILDING A RAILROAD IN SAVAGE AFRICA

Giraffes and Elephants Pull Down the Telegraph Wires—Hostile Savages Pull Up the Tracks to Make Spears

By W. G. Fitzgerald

Slowly, but surely, the Dark Continent is being conquered for civilization, and the most potent factor in this is certainly the railroad. Already from Cape Town, in the south, as far north as Lake Tanganyika, 2,000 miles, the Cape to Cairo line has won its way and in East Africa, the Uganda Railroad has fought with wild beasts, hostile tribes, fever and pestilence, until today its shining tracks stop short on the shores of the great Victoria Nyanza, that vast inland sea of Central Africa. Even in the cannibal Congo the Belgians are pushing railroad construction, and the Portuguese on the Indian Ocean, the Germans in West Africa and the French on the Ivory Coast are all laying down tracks and winning a way into a wilderness hitherto given up to lion and rhino, elephant and giraffe.

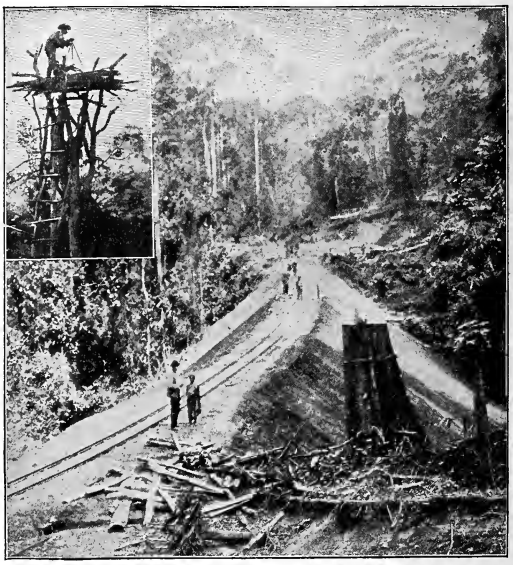


Natives Making an Embankment through Ashanti Jungle

Now consider for a moment what such an undertaking means. The country is primeval jungle with trees whose upper branches are knitted together by gorgeous orchids and other floral parasites. The only "roads" are the beaten tracks which the herds of elephant have made as they crashed through the jungle on their way to water. Then, too, it must be remembered how dangerous a country this is for the white man, owing to the deadly fevers so easily contracted, not to mention sudden descents of hostile savages, and attacks from wild beasts, and poisonous snakes. Worse still, there is the question of labor. As every explorer knows, the African native hardly does a stroke of work from childhood to the grave. A living is to be had by merely scratching the ground, or bringing down antelope with the bow and arrow; and all the necessary labor is done by the women. And when a railroad company does succeed in getting a few thousand native laborers, there is sure to be an outbreak of that most mysterious of all diseases known as "sleeping sickness" which last year swept away 200,000 natives on the Congo

alone. Animal transport, chiefly mules and oxen, was to be had at one time, but all these four-legged helpers are now impossible by reason of the dreaded tsetse fly, which has actually compelled the Belgian officials to introduce, on a large scale, zebras, as beasts of burden which might possibly be proof against the poison of this insect.

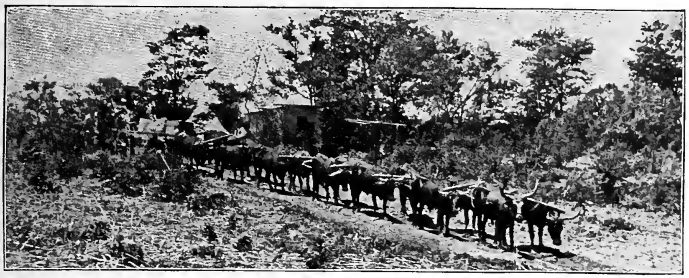
Thus, it will be seen that the construction of a railroad in savage Africa is indeed a heroic undertaking. In the first place gangs of savage laborers go ahead and clear the jungle of trees and brush. Behind comes another party digging holes for the telegraph posts, and last of all come the tracklayers. Now the surveying pioneers who map out the course have all the difficulties and dangers of the explorer in an unknown land to contend with. Had I space I could tell thrilling lion stories more exciting than any fiction, of camps attacked in the night by howling savages; of mysterious disappearances of white men. But these are the ordinary incidentals of an African pioneer railroad. On the Uganda line all operations were stopped for two months at Tsavo station, owing to the depredations of a man-eating lion and lioness which had so terrorized the native workers that at length they dropped their tools and disappeared in the wilderness. There was nothing for it but to track and kill the lions—a highly risky and difficult work, for both were old and crafty. Like all man-eaters their fangs had become so worn and their joints stiff with age that they could no longer chase the swift antelope which is their ordinary prey. And under such conditions is it that the larger carnivora seek human beings as being much easier to secure. The strange thing is, that once having tasted human flesh, a lion rarely cares for any other prey. Three or four surveyors and engineers of the Uganda railroad were specially sent from Mombasa to Tsavo, where they took up their quarters every night in the old pay coach which ran up and down the line once a month distributing pieces of cotton cloth, cowrie shells, and brass wire—the currency of Central Africa.



Surveyors Work from Tree Tops

For many days and nights the lion and his mate continued to carry off employes of the road, avoiding the white watchers with almost human cunning. Indeed they appeared to grow more and more daring, and the climax came one evening when a Hindu paymaster was picked off an open freight car by the lioness, who made a sudden

swoop from the grass thicket and dragged him off shrieking into the jungle. That same night was marked by a still more terrible tragedy. One of the white engineers towards two in the morning dropped off to sleep in the coach with his express rifle across his knees. There was a sudden scuffle, and before his comrades knew what had happened the maned head and massive paws of the male lion were thrust in at the open window, and the sleeping man dragged out and carried off into the forest. His pitiful remains were found some weeks later. It is satisfactory to learn that both lion and lioness were eventually bagged, but even after their magnificent skins were exhibited all up and down the line it was very difficult to induce the laborers to return to work.



Material is Hauled by Long Horned Oxen

And even when the railroad was opened for traffic, the patroling of it was a most difficult undertaking. On no less than five occasions giraffes 15 and 20 ft. high were found dead by the way, having been strangled by the telegraph wires which they had run against blindly and dragged down with their long necks. Then, too, some of the blood-thirsty Masai regarded the shining steel tracks as heaven-sent material for their own weapons, so that it was no uncommon incident to find great gaps in the track where the savages had stolen the metal to be forged into spears and arrow-heads in their rude village smithies.

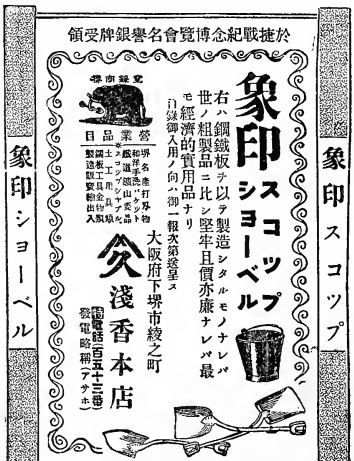
Another great difficulty was encountered in the Arab slave raiders who make periodical descent upon Central African villages in order to supply the slave markets of Egypt, Persia and Turkey. Sometimes hundreds of the laborers would be kidnaped and their villages burned with circumstances of great atrocity. Accordingly the white authorities had to maintain little standing armies whose forces could be entrained at any given spot on receiving news by telegraph, and swiftly transported to the scene of a raid. On such occasions serious pitched battles would be fought, but victory always lay with the railroad people, who were better armed and had the strategic advantages of their rolling stock. Yet another difficulty was experienced from the herds of wild elephants. Many of these brutes appeared to think that the telegraph poles were put there specially so that they might rub themselves against them. Or an angry tusker whose upraised trunk had been hurt by the wire would think little of uprooting the poles for miles or more. It is surely an amazing monument to the pluck and persistence of the white man in Africa that even in the face of all these difficulties railroad work is being pushed with feverish zeal in all parts of the continent from Uganda to the Senegal, and from the Zambesi to the sources of the Nile.

Rich mineral and agricultural lands are being opened up and capital introduced from all nations. Cotton, tobacco and wheat are being grown on the

highlands of British Central Africa, and luxurious trains are now crossing the stupendous falls of the Zambesi at a point where one of the world's mightiest rivers two miles wide falls over an appalling precipice 400 ft. deep. Long ago the various nations interested in the development of Africa, realized that the best way to conquer all the forces arrayed against them there was to clear a way into the heart of the continent for the iron horse, which is fast carrying prosperity and the blessings of civilization into regions where but a year or two ago a white face had never been seen.

IRON IN CUBA

After boring several thousand holes and making other explorations covering a period of two years, it is announced that there is quantities of iron in Cuba. The body of ore already located is estimated at 600,000,000 tons, and only 12 miles from a good harbor. Steel interests in this country have already secured 27,000 acres.



The above is an advertisement of railroad supplies appearing in a Tokyo, Japan, railroad journal.

MOTORCYCLE MAKES RATE OF 90 MILES PER HOUR

At Atlantic City William H. Bray, jr., made an official mile from a flying start in 38 seconds, or at the rate of 90 miles per hour. The machine is of

W. H. Bray, Jr.

French construction and is a two-cylinder 14-hp. and broke the world's record last year at 61 miles per hour.

ILLUMINATING GAS FROM CORN-COBS

The town of Beatrice, Neb., has the only gas plant in the world that manufactures commercial illuminating gas from corn-stalks, corn-cobs, hay, and vegetable matter. The quality is as good as coal gas and it sells for $1.18 per thousand cubic feet, the lowest price in any city in Nebraska. The plant cost $100,000 and John D. Rockefeller is thought to be back of it, as the franchise is held by the Rev. Charles Eaton, pastor of Rockefeller's church in Cleveland. There are a number of manufacturing plants which make a cheap grade of gas out of bark and hay for use in gas engines, but it is believed that this is the first instance where vegetable matter has been utilized for the manufacture of illuminating gas.

During 1906 in the state of Pennsylvania, 126 boys between the ages of 16 and 21 years were killed in the coal mining regions.

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